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EXAMINATION OF COMMERCIAL SAMPLES OF AMYL NITRITE AND SPIRIT OF NITROUS ETHER, AND A NEW METHOD FOR THEIR VALUATION.

By Carl E. Smith.

Report from Research Committee D, Section II, of the Committee of Revision of the U. S. Pharmacopœia.

As the ethereal nitrites are exceedingly unstable bodies, gradually deteriorating, notwithstanding all possible care taken in their preservation, it would seem incumbent upon the dispensing pharmacist, not only to prevent deterioration as much as possible by proper precautions, and to make or purchase these preparations only in such quantities as can be used in a short time, but also to determine from time to time the extent of change that has taken place, as indicated by loss of strength, increase of acidity, etc. An article purchased from a reliable firm, or made by the pharmacist himself, may meet all requirements when made or received, but, after having been kept some time, it will have suffered sufficient loss of strength to require an increase of dose, if not to be rejected entirely, and this loss cannot be even approximately determined without suitable quantitative tests. That such tests are necessary, is shown by the frequent reports in the journals upon these substances purchased in drug stores, and found nearly always much below the official standard, in some cases even entirely devoid of nitrite.

Many pharmacists might possibly be persuaded to test their supplies of amyl nitrite and spirit of nitrous ether, if they were not deterred by a seeming, though not real, complexity of the present

U.S.P. method of assay, and by the necessity of either purchasing a special apparatus, a nitrometer, or else taking the trouble to improvise one from other apparatus at hand. Hence, the control of the strength of these preparations, under present conditions, is restricted almost entirely to manufacturing and analytical laboratories. It is a desideratum, therefore, for the pharmacist to be in possession of a method of valuation that does not require special apparatus and, in other respects, is adapted to the requirements of the dispensing pharmacist. In a search for such a method, the writer has examined, without success, those of the older existing methods of titration that appeared most promising, but has succeeded in adapting a new method, very recently proposed for alkali nitrites, to the estimation of ethyl and amyl nitrite. It is readily applied by any one who is acquainted with the rudiments of volumetric analysis, and requires only the ordinary apparatus employed in such work. Experiments seem to show also, that it is capable of greater accuracy than the gasometric method, which is in general use at present. Before describing it fully, an account of the experiments made in connection with the other methods tried will be given.

The U.S.P. method is essentially that of A. H. Allen (Ph. J. Tr., 1885, ser. 3, vol. 15, p. 674), who makes use of the following reaction, by measuring the nitric oxide formed:

$$2C_2H_5NO_2 + 2KI + 2H_2SO_4 = 2C_2H_5OH + N_2O_2 + I_2 + 2KHSO_4.$$

This reaction had previously been employed by D. B. Dott, who recommended titrating the liberated iodine with thiosulphate. This procedure was soon found unreliable by Allen and others, and was superseded by Allen's gasometric modification. The cause of inaccuracy is the instant oxidation of nitric oxide (N_2O_2) on contact with air, to nitrogen tetroxide (N_2O_4), which continues to set free iodine from the hydriodic acid in solution, and causes the result to be much too high. Mr. Dott then proposed a modification (Ph. J. Tr., (3) vol. 15, p. 697), in which air was to be excluded by generating carbon dioxide within the vessel in which the operation was performed, but this also failed to find the approval of others. It has further been recommended to conduct the operation in an atmosphere of coal-gas, and accurate results have been reported by the employment of this, but the necessity of having a specially constructed apparatus and the care and practical skill required to obtain serviceable results

have prevented this modification from becoming popular. D. Walker (*Am. Drug.*, 1896, p. 79) reported results agreeing fairly well with others obtained by nitrometer, through substitution of acetic for sulphuric acid in Dott's method and without precautions to exclude air. L. A. Kessler (AM. JOUR. PHAR., 1897, p. 307) found this unsatisfactory because of liability of giving too high results.

The conflicting statements regarding this method in its various modifications induced the writer to make some experiments to determine if it could not in some way be adapted to the use of the pharmacist for approximate estimations.

When spirit of nitrous ether, solution of potassium iodide and dilute sulphuric acid were mixed in a flask with access of air, in the same proportions as in the gasometric method, the quantity of iodine liberated in a few moments would be two or three times as much as was required by the nitrite present; when the spirit was diluted with water before admixture with the reagents, the liberation of the iodine was slower, but also greatly in excess of the theoretically required amount, and, after decoloration, the solution would rapidly become brown again from further liberation of iodine.

When access of air was prevented by a layer of liquid paraffin on the surface, the reaction was not complete in any reasonable time, only one-half to two-thirds of the actual amount of nitrite being indicated. At the same time a portion of the iodine dissolved in the paraffin, thus in part escaping titration.

Dott's later method consists in mixing 10 c.c. each of a 10 per cent. solution of potassium iodide, of a 15 per cent. solution of potassium bicarbonate, of rectified spirit and 5 c.c. of spirit of nitrous ether, then adding 10 c.c. of dilute sulphuric acid and, after a half hour, titrating with thiosulphate. Following these directions in assaying a spirit that gave 4·9 per cent. of ethyl nitrite by the gasometric method, the results ranged from 2·6 to 3·2 per cent., and when the solutions were left undisturbed for a few moments after titration of the iodine, iodine was liberated at the surface, showing it to be effected through external influence.

With the use of acetic instead of sulphuric acid, as proposed by Walker, the liberation of iodine was still slower, in the case of protection from the influence of the air by means of liquid paraffin. Without this protection it was considerably faster, but due nearly as much to the oxidizing influence of the air as to reaction within

the solution. While it is possible that, by carefully maintaining all conditions of time, dilution, surface exposure, etc., results agreeing approximately with those of the gasometric method may be obtained, it is the writer's experience that parallel experiments by both methods, and considerable practice are required to accomplish this.

The late Prof. Charles O. Curtman published (*Ph. Rundschau*, 1892, p. 156) a modification of Eykman's gasometric method, which depends upon the following reaction:

$$2C_2H_5NO_2 + 2\,FeSO_4 + H_2SO_4 = N_2O_2 + 2C_2H_5OH + Fe_2(SO_4)_3.$$

The modification consists in expelling the nitric oxide by boiling, and estimating the quantity of ferric salt formed in the reaction, by adding potassium iodide and titrating the liberated iodine with thiosulphate. Dr. Curtman proceeded by measuring into a 100 c.c. flask 10 c.c. of a normal solution of ferrous ammonium sulphate, 10 c.c. of normal sulphuric acid and 5 c.c. of the spirit to be tested, and allowed the mixture to stand a half hour, after stoppering the flask carefully with a rubber or cork stopper. The stopper was then loosened, but not taken off, and the contents of the flask heated rapidly to boiling, which was continued until all nitric oxide had been expelled from the flask, the stopper being removed toward the end. The contents of the flask were then cooled to 40° C., 10 c.c. of normal potassium iodide solution added, the solution kept at 40° C. for one hour, and the iodine titrated after cooling.

Dr. Curtman did not claim great accuracy for this method, and gave preference to Allen's gasometric method. Following the directions above given, the present writer obtained 4·03, 3·38 and 4·07 per cent., against 4·59 by nitrometer. After several unsuccessful attempts, 4·75 per cent. was obtained in duplicate estimations, by doubling the time allowed for the reaction in the first part of the process. Aside from the fact that it requires considerable care and attention, this method is subject to several sources of error that are likely to discourage its use. The nitric oxide acts as a carrier of oxygen and raises the result, though to a less extent than is the case with the first method discussed. This is evidenced by the fact that the results were always much too high when the mixtures of ferrous sulphate, sulphuric acid and spirit were allowed to stand much longer than one hour before expelling the nitric oxide. The liability of ferr*ous* salts to contain ferr*ic* salts is also apt to cause error and inconvenience.

The new method alluded to at the beginning of this paper is based on a reaction between nitrous and chloric acid, thus:

$$3HNO_2 + HClO_3 = 3HNO_3 + HCl.$$

This reaction has long been known, but seems not to have been utilized for quantitative purposes until recently. An abstract in *Ztsch. f. ang. Chem.*, 1898, p. 307, which is the only reference to this method the writer has been able to find, is translated as follows:

"*Estimation of Nitrites.*—B. Grützner (*Rev. fals.*, 1898, 21), dissolves 0·1 to 0·2 gramme of the nitrite in 500 c.c. of water, adds 0.5 gramme of potassium chlorate and a known volume of $\frac{N}{10}$ silver nitrate, strongly acidulates with nitric acid, while shaking, and titrates after a few minutes the excess of silver with $\frac{N}{10}$ sodium chloride." It would have been of interest to see the original article, to learn the reasons for some of the procedures directed, but the conclusion is reached that the method is intended primarily for alkali nitrites, as it is utterly inadequate in the above form for the estimation of ethyl and amyl nitrite.

For metallic nitrites, from which nitric oxide is set free immediately upon addition of a stronger acid, such great dilution with water, as is directed, may not be objectionable, and will prevent loss of nitric oxide when the reaction is permitted to go on in an open vessel, but a large quantity of water is not necessary for the estimation of sodium and potassium nitrites in the writer's experience, when a well-stoppered flask is used, and in the assay of ethereal nitrites such a dilution would retard the reaction to such an extent as to make the method impracticable. With a bulk of 50 c.c. for 0·2 gramme of ethyl nitrite, about thirty minutes was required for a complete reaction, and ten to fifteen minutes for a bulk of 25 c.c. Greater dilutions than these would only cause an unnecessary loss of time.

The addition of silver nitrate at the beginning, as directed by Grützner, necessitates keeping the solutions in a dark place until they are ready for titration, but as it has been found that frequent shaking is required to facilitate the reaction, exclusion from light is rather inconvenient. For this reason parallel experiments were made

to determine if it would be justifiable to omit the silver nitrate until the reaction between nitrite and chlorate was ended. In two estimations the silver nitrate was added at the beginning, and the mixture excluded from light as much as possible; in two others no silver nitrate was added and the solutions placed into the light. All of them were otherwise treated in the same manner, as nearly as possible, and titrated after standing the same length of time. The results were 4·55 and 4·52 per cent. for the first pair and 4·65 per cent. for each of the second. It is seen that the figures are somewhat higher when the silver is not added until reaction is complete, which has been confirmed by subsequent estimations, but it is probable that they are more nearly exact.

It was also thought expedient to substitute potassium or ammonium sulphocyanate for sodium chloride in residual titration, so as to permit the use of a color-indicator, which much facilitates the work.

In the following experiments, made to determine the time required for an estimation, 25 c.c. of water, 5 c.c. of a saturated solution of potassium chlorate, 5 c.c. of spirit of nitrous ether, and 5 c.c. of 10 per cent. nitric acid were successively placed into a 100 c.c. flask, which was at once securely stoppered, and allowed to stand a definite length of time, with occasional shaking, and then titrated. The spirit used assayed 4·28 per cent. by nitrometer.

Time allowed for reaction.	Per Cent.
5 minutes	3·75; —
10 "	3·85; —
15 "	3·91; 4·11
30 "	4·29; 4·34
60 "	4·55; 4·60
Over night	4·65; 4·65

Under the above conditions, then, at least an hour is required to obtain results approaching the maximum per cent. obtainable. The highest figures also show a decided increase over the per cent. obtained by nitrometer. An increase had been expected, as the gasometric method has always been supposed to yield somewhat low results, but not such a great one. A similar difference was found in all samples of spirit of nitrous ether examined and a still greater one in amyl nitrite, but, as will be shown later, the results by the new method are entitled to more credence.

In further attempts to shorten the method, it was found that

further limitation of the bulk of the solution and persistent shaking materially hasten the reaction. With 10 c.c. of water, instead of 25 c.c., and frequent shaking, 4·58 and 4·6 per cent. was obtained after fifteen minutes. Without any addition of water 4·55 and 4·58 per cent. was obtained in the same length of time. In the latter case the solution became yellow, showing secondary reactions, and this degree of concentration is therefore not advisable, although the figures obtained are normal. Frequent shaking is required to bring into contact with the solution the vapors of ethereal nitrite diffused through the air above the liquid, which would otherwise remain unchanged for a considerable time.

The high results of this method, as compared with Allen's gasometric method, led to the suspicion that they might be due to the presence of aldehyde, but a few experiments showed that this was not the case. The same spirit as had been used in the experiments given above was assayed with the addition of 0·1 c.c. and 0·2 c.c. of 99 per cent. paraldehyde, respectively, to 5 c.c. of the sample, a great deal more of aldehyde than could possibly be present in any sample tested. The results were practically the same as without aldehyde, namely, 4·60 and 4·54 per cent. This was repeated with 0·5 c.c. and 1·0 c.c. of the aldehyde for 5 c.c. of spirit and the mixtures allowed to stand over night before tritrating. The results were 4·3 and 4·12 per cent. The presence of aldehyde, therefore, affects the accuracy only when a very large quantity of it is present and in such a case does not increase, but *decreases* the result. No interference need be feared from the amount of aldehyde naturally present.

To obtain further data about the reliability of the method, an attempt was made with pure silver nitrite. If the reaction proceeded according to theory, exactly one-third of the silver in the salt would be converted into chloride, and the remainder stay in solution in form of nitrate, according to the following equation:

$$3AgNO_2 + KClO_3 = AgCl + 2AgNO_3 + KNO_3.$$

A very rapid blackening of the precipitate, as soon as exposed to light, however, the cause of which is not known, made the estimation impracticable. The silver nitrite used had a good appearance, and gave 70 2 and 69·95 per cent. of silver, 70·1 per cent. being required by theory.

A specimen of sodium nitrite, sold as meeting the U.S.P. requirements (not less than 97·3 per cent. pure) was assayed by the new method, which gave 98·8 and 98·5 per cent., and also by the gasometric method, which gave 100·3 and 100 9 per cent., correction being made for temperature only. The figures obtained by the latter method are evidently too high, and the error is perhaps mainly caused by the failure to make correction for pressure and vapor tension, which might easily have reduced them to 98 per cent. The results of the new method are, without doubt, nearer the actual percentage. This still leaves unexplained the fact that the old method invariably gives considerably lower results than the new in the estimation of ethereal nitrites. The surmise that it might be partially due to an increase in solubility of nitric oxide in the nitrometer liquid, through presence of alcohol, was disposed of by parallel estimations of sodium nitrite with and without alcohol. The last estimations recorded were repeated immediately, under the same conditions of atmospheric pressure, temperature, etc., but with addition of 5 c.c. of alcohol to the aqueous solution of sodium nitrite in the nitrometer before adding the reagents. Instead of being lower, the results were a little higher, 101·3 and 101·0 per cent.

An old, deteriorated specimen of potassium nitrite, which gave 78·3 and 78·6 per cent. by the new method, assayed 80·1 and 79 6 per cent. by nitrometer, corroborating the results obtained on the sodium nitrite.

There was still a possibility that some of the by-products that usually accompany ethyl nitrite in addition to aldehyde, such as ethyl formate, acetate, oxalate and ethyl ether—and the corresponding ones in the case of amyl nitrite—might be accountable for the high figures given by the new method. The fact that the differences in the results of the two methods are in fairly uniform ratio, for products from different sources and doubtless varying methods of preparation, however, makes this very improbable. To settle this point, the following experiment was made: To an aqueous solution of about 8 grammes of the same sodium nitrite as had been used in previous experiments, 0·5 gramme each of sodium formate and sodium oxalate, and 0·5 c.c. each of ether, ethyl acetate, and paraldehyde were added, and the solution assayed in the same manner as had been done without addition by the new method. This gave 95·2 and 94·5 per cent., instead of 98·5 and 98·8 per cent., which

was the result given by the nitrite alone, indicating that the impurities usually contained in ethyl nitrite do not raise, but rather tend to lower the results of the method. All evidence so far adduced, then, tends toward the same direction, *i. e.*, that the method is not liable either to give too high or too low results under ordinary conditions, and that under abnormal conditions the tendency is toward low rather than high results. The natural inference, therefore, is that the results of Allen's gasometric method are always too low in the estimation of ethereal nitrites.

The following details have been adopted as being considered the most practical:

Valuation of Spirit of Nitrous Ether.—Into a 100 c.c. flask or bottle of white glass, provided with a loosely-fitting stopper of glass, rubber or cork, place successively 10 c.c. of distilled water, 5 c.c. of a cold, aqueous, saturated solution of potassium chlorate, 5 c.c. of the spirit to be tested, and 5 c.c. of 10 per cent. nitric acid. Quickly insert the stopper and shake frequently during thirty minutes. Then add 10 c.c. of $\frac{N}{10}$ silver nitrate, shake briskly for a moment, add 10 drops of ferric ammonium sulphate solution, and titrate the excess of silver with $\frac{N}{10}$ potassium sulphocyanate. (The titration should be performed without delay, to avoid darkening of the precipitated silver chloride by the influence of light, which interferes with the end-reaction.) The end-point is reached when, after *momentary* shaking, upon addition of the last drop of solution, the appearing red color is not entirely dispersed, but leaves the liquid faintly reddish throughout. The color will frequently disappear after *persistent* shaking or after standing a while, but no attention need be paid to this. Assuming the spirit to contain 4 per cent. by weight of ethyl nitrite, and to have a specific gravity of 0·84, it would require 2·55 c.c. $\frac{N}{10}$ potassium sulphocyanate to precipitate the excess of silver in solution. As each cubic centimeter of $\frac{N}{10}$ silver nitrate consumed in precipitating the chloride formed corresponds to 0·0225 gramme of ethyl nitrite, the calculation is as follows:

$$\frac{(10 - 2{\cdot}55) \times 0{\cdot}0225 \times 100}{5 \times 0{\cdot}84} = 4{\cdot}0 \text{ per cent.}$$

If the specific gravity of the sample is assumed to be 0·84, which is approximately correct in most cases, the calculation can be shortened by simply multiplying the number of cubic centimeters of $\frac{N}{10}$ silver nitrate required by 0·536. In this case it is $7·45 \times 0·536 = 4·0$ per cent. This factor can be employed only when 5 c.c. of spirit are taken for assay. If it is desired to avoid calculation entirely, 2·7 c.c. of spirit and half the quantities of the reagents may be taken, in which case each cubic centimeter of $\frac{N}{10}$ silver nitrate indicates 1 per cent. of ethyl nitrite.

Concentrated nitrous ether may be assayed by diluting with alcohol in definite proportions, or in accordance with the directions on the label, and proceeding as in the assay of spirit of nitrous ether.

Valuation of Amyl Nitrite.—Partially fill a 100 c.c. graduated flask with alcohol, insert the stopper and weigh. Add five to six grammes of the amyl nitrite to be tested and weigh again. Fill the flask to the 100 c.c. mark with alcohol and mix thoroughly by shaking. Then proceed in the same manner as directed for spirit of nitrous ether, using 20 c.c. of distilled water, 10 c.c. of the saturated solution of potassium chlorate, 10 c.c. of the alcoholic dilution of amyl nitrate and 10 c.c. of dilute nitric acid: Also use 20 c.c. of $\frac{N}{10}$ silver nitrate and titrate the excess as directed above, observing the same precautions. The calculation of results is made as explained by the following example: Assuming the alcoholic dilution to contain 6·037 grammes of the sample in 100 c.c., the 10 c.c. taken for assay contain 0·6037 gramme. If in titrating the excess of silver, 5·45 c.c. of $\frac{N}{10}$ potassium sulphocyanate are required, $(20 - 5·45 =)$ 14·55 c.c. of $\frac{N}{10}$ silver nitrate, each cubic centimeter equivalent to 0·0351 gramme of amyl nitrite, have been consumed in precipitating the chloride formed in the reaction. The calculation then is

$$\frac{14·55 \times 0·0351 \times 100}{0·6037} = 84·6 \text{ per cent.}$$

In the application of this method care must be taken either to use pure reagents or to make allowance for the interfering impurities

they may contain, which is easily done. Potassium chlorate and nitric acid, in their commercial forms, nearly always contain chloride, but they can readily be obtained free from it. Ammonium ferric sulphate may also contain chloride in traces. Nitric acid may contain lower oxides of nitrogen, indicated by a yellow color of the acid and brown vapors in the air-space of the container. The correction is most readily made by mixing these reagents in the same quantities as used in the assay and allowing the mixture to stand a while. If, on the addition of a few drops of $\frac{N}{10}$ silver nitrate, only a slight opalescence appears, no correction is necessary; if the solution becomes decidedly turbid or a precipitate is formed, a known volume of silver nitrate should be added and the excess determined with sulphocyanate. The silver nitrate required to precipitate the chloride is deducted from that required in the actual assay.

Commercial Samples.—The samples reported upon below were purchased in original packages in the open market and fairly represent the American market. They were assayed by both the U.S.P. and the new chlorate method, and also subjected to the other pharmacopœial tests. The acidity is given in terms of nitrous acid for the sake of convenience, although it is not known that the free acid consists entirely of this. For the same reason no deduction is made from the percentage of ethereal nitrite, for the free nitrous acid included in the estimations as ethyl or amyl nitrite.

SPIRIT OF NITROUS ETHER.

No.	P. C. Strength by U.S.P. Method.	P. C. Strength by Chlorate Method.	Per Cent. of Free Acid.	Aldehyde.
1	3·66; 3·70	4·06; 4·01	0·14	Faintly yellow
2	4·84; 4·88	5·30; 5·30	0·11	" "
3	4·28; 4·31	4·58; 4·60	0·45	Dark "
4	3·95; 4·00	4·38; 4·44	0·15	Straw "
5	4·35; 4·32	4·81; 4·84	0·31	Dark "
6*	85·5; 85·9	92·6; 92·0	0·46	Straw " (Tested after dilution to 4 per cent.)

* Concentrated nitrous ether, stated to be 90 per cent. ethyl nitrite.

The acid determinations were made with $\frac{N}{1}$ soda, with phenolphthalein as indicator and without dilution with water. When water

was added to the spirit before titrating, or when the undiluted spirit was titrated with $\frac{N}{10}$ instead of $\frac{N}{1}$ soda, considerably higher figures were obtained, doubtless through saponification of the esters. The U.S.P. test for limit of acid in spirit of nitrous ether is the addition of a crystal of potassium bicarbonate, which must cause no effervescence. No acid could be detected in any of the samples by this test. After dilution with an equal volume of water and addition of the bicarbonate, No. 2 caused bubbles of gas to rise from the surface of the crystal slowly; No. 3, under the same conditions, more rapidly. It would not be safe, however, to depend on the test thus performed, owing to the rapid decomposition of ethyl nitrite in presence of water. Titration with $\frac{N}{1}$ alkali seems to be the most satisfactory.

The remarks in the aldehyde column refer to the color of the spirit after prolonged contact with alkali, under the conditions prescribed by the Pharmacopœia, which requires that the color should not be decidedly brown within twelve hours after admixture. The requirements are therefore fully met by all samples.

AMYL NITRITE.

No.	P. C. Strength by U.S.P. Method.	P. C. Strength by Chlorate Method.	Per Cent. of Free Acid.	Aldehyde.
1	77·2; 77·0	87·0; 87·4	0·6	Dark straw color
2	76·0; 76·4	86·7; 86·2	0·67	Brownish yellow
3	17·3; 18·8	21·0; 18·9	0·76	Deep yellow
4	82·7; 83·5	93·9; 93·4	1·36	Dark straw color
5	79·0; 78·4	85·9; 85·3	1·12	Deep yellow

Excepting No. 3, the samples are fairly well in accord with the pharmacopœial requirements. This sample was somewhat lighter in color than the others, and had a peculiar musty odor, probably derived from the stopper, which was old and defective, and had been badly attacked by the contents of the bottle.

Nos. 4 and 5 exceed the limit of acid set by the Pharmacopœia, which is 1·08 per cent., interpreted in terms of nitrous acid. It was found most convenient to determine the acidity by titrating an alcoholic dilution of the ether with $\frac{N}{1}$ soda, using phenolphthalein as indicator.

In testing for aldehyde, the Pharmacopœia requires that on shaking equal volumes of amyl nitrite and $\frac{N}{1}$ potassium hydrate, the aqueous layer shall not be more than pale yellow. As the table shows, none of the samples is fully up to the standard in this regard.

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ORIGIN AND DETECTION OF MUCILAGE IN PLANTS.

BY HENRY KRAEMER.

By the term "mucilage in plants" is meant those substances which are soluble, or at least swell very perceptibly in water, and which, upon the addition of alcohol, are precipitated in a more or less amorphous or granular mass. Mucilage originates in the plant either as a part of the contents of the cell or as a part of the wall thereof. When it occurs as a part of the cell contents (as cell-sap), mucilage is produced either as an "Auscheidung" from the protoplasm, or it may possibly arise in some cases as a disorganization product of some of the contents. When it occurs as a "membrane mucilage," it owes its origin to several causes, viz.: either as a form of secondary thickening or addition product to the wall; or as a metamorphosis of the cell wall, at least in part. In the latter case it may arise either as a disorganization product of the primary wall as an intercellular substance; or of the subsequent lamellæ making up the pith, medullary ray, parenchyma and other cells. In addition to these two well-authenticated cases of the origin of mucilage, viz., as a cell contents and cell-membrane, we have mucilage given out by some secreting hairs (glands). In such instances we can simply say that the mucilage appears between lamellæ of cutin on the one hand and of cellulose on the other hand, of the epidermal cells of the secreting hair.[1]

For convenience of reference, the following table, containing some

[1] De Bary, *Vergleichende Anatomie*, S. 98.

of the important official plants yielding a mucilage, together with the origin of the same, is given:

I. *Cell-Contents Mucilage.*
1. Corm of *Orchis* sp. (Salep).
2. Rhizome of *Agropyrum repens*, L., Beauvois (Triticum).
3. Bulb of *Urginea maritima*, L., Baker (Squill).
4. Bulb of *Allium* sp. (onion, garlic).
5. Stem, leaf and elements of flower, excepting stamens, of *Viola tricolor*, L.
6. Flower-stalks of *Hagenia abyssinica*, Bruce, Gmelin (Cusso).
7. Pulp of fruit of *Musa paradisiaca* (Banana).
8. Succulent plants, as Aloe, etc.

II. *Cell-Membrane Mucilage.*
A. *Secondary thickening of wall.*
1. Root of *Althæa officinalis*, L., (Althæa).
2. Bark of *Cinnamomum* sp. (Cinnamon).
3. Bark of *Rhamnus Frangula*, L. (Buckthorn).
4. Bark of root of *Sassafras variifolium*, Salisbury, o. *Kuntze* (Sassafras).
5. Inner bark of *Ulmus fulva*, Mx. (Elm).
6. Leaves of *Barosma betulina*, Thunberg, Bart. et Wend, and *B. crenulata*, L., Hooker (Buchu).
7. Seed-coat of *Cydonia vulgaris*, L., (Quince).
8. Seed-coat of *Linum usitatissimum*, L. (Flaxseed).
9. Seed-coat of *Sinapis alba*, L., Hook. fil et Thompson, and *S. nigra*, L., Koch (White and Black Mustard).

B. *Metamorphosis of Cell-wall.*
a. Pith and Medullary Ray Cells.
1. *Astragalus* sp., yielding Tragacanth. [1]

β. Parenchyma cells of wood and bark.[2]
1. Cherry-gum, yielded by some of the Amygdalaceæ.

γ. Various cells of the bark.
1. *Acacia Senegal*, Wild., yielding Gum Arabic.[3]

δ. Primary wall as intercellular substance.
1. Thallus of *Chondrus crispus*, Stackhouse, and *Gigartina mamillosa*, J. Agardh (Irish moss).

III. *Secreting Hairs* (*Drüzenzotten*).
1. Leaf and calyx of *Viola tricolor*, L.
2. Leaf of *Coffea arabica*, L. (Coffee).
3. Leaf of *Prunus avium*.[4]

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[1] Mohl, *Bot. Zeit.*, 1857, S. 33.

[2] Tschirch, *Angewandte Pflanzenanatomie*, S. 210.

[3] Wigand, Pringsheim's Jahr., III, 115. Mœller, Wiener Akad., 1875, 219. Tschirch, *loc. cit.*, 213.

[4] J. Reinke, *Bot. Zeit.*, 1874, 47 and 59.

The origin of mucilage as an "Auscheidung" from the protoplasm has been pointed out in the corms of various species of Orchis, by Frank,[1] Meyer[2] and Hartwich.[3] All have contributed more or less confirmatory researches toward this end. Frank says that in the young cells of the tuber of Orchis, near the nucleus occurs a bundle of needle-like crystals, around which a clear mucilage drop is formed. This becomes larger and larger, and finally when fully grown replaces the protoplasm and nucleus, and occupies the lumen of the cell. Arthur Meyer, on the other hand, claims that the protoplasm in Orchis species does not disappear, but that it is to be found in the older stages of the cell, and that the peripherical layer of protoplasm secretes the mucilage which lodges in between the "plasmanetz" (*i.e.*, in the vacuoles). Hartwich confirms the labors of Meyer in that he finds the peripherical layer of protoplasm in the latter stages of the life of the cell, but he does not observe the "plasmanetz." He also says, in cells of *Orchis latifolia* and *O. Morio* that do not contain raphides, the mucilage does not arise in the middle of the cell.

It is not unlikely but that in all of the plants mentioned as having a "cell-contents mucilage," and which contain rhapides of calcium oxalate as scilla (*Fig. 6*), that the origin is similar to that of Salep, viz., as an "Auscheidung" from the protoplasm[4].

In *Viola tricolor*, L.,[5] is found, as has been previously shown by the author, peculiar sub-epidermal mucilage cells, which occur in all the leaf-like elements of the plant with exception of the stamens. These are easily ascertained by placing fresh specimens of the leaf in an alcoholic solution of methylene blue of the following strength:

ALCOHOLIC METHYLENE BLUE SOLUTION.

Methylene blue	0·400 grammes.
Alcohol (95 per cent.)	100· c.c.

The specimen is left in this solution for at least several hours, after which surface or transverse sections may be made and are transferred to a slide having a few drops of the following mixture:

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[1] *Pringsheim's Jahr. f. wiss. Bot.*, V, p. 161.
[2] *Arch. d. Pharm.*, 1886, p. 325.
[3] *Arch. d. Pharm.*, 1890, p. 563.
[4] See also Tschirch, *loc. cit.*, S. 109, 125.
[5] Inaugural Dissertation, Marburg, 1897.

GLYCERIN METHYLENE BLUE SOLUTION.

Methylene blue	0·400	grammes.
Alcohol (95 per cent.)	20·	c.c.
Glycerin (nearly anhydrous)	80·	c.c.

The cover-glass is put upon the section, and in a short time the mucilage cells are stained blue (as *Figs. 1, 2, 3*) and are readily distinguished from the remaining unstained cells. Preparations so prepared may be kept indefinitely. In fact in a few weeks the contrast is even more marked than on the first day.

The nature of the contents of the sub-epidermal mucilage cells may be best studied by sectioning alcoholic material and mounting in alcohol. If to a preparation of this kind an alcoholic solution of iodine is added, the protoplasm nucleus and plastids become light brown in solor. If to a transverse section in alcohol (as *Fig. 4*) is added chlorzinciodide, the mucilage gradually swells, and the sub-epidermal cell becomes about twice the size as when seen in alcohol. The wall between the two cells becomes blue, but the mucilage is not altered in color.[1] Surface sections of the leaf, treated with an alcoholic iodine solution, and then with an alcoholic sulphuric acid solution (containing two volumes of alcohol to one volume of concentrated H_2SO_4), allow for a closer study of the nature of the contents. (*Fig. 5*) The nucleus is central and is surrounded by a small amount of cytoplasm. From here to the peripherical layer of the protoplasm extend numerous threads of the same substance. In the periphery are a number of small plastids, being fewer and smaller than in the epidermal cells.

The fresh pulp of banana fruit treated with an alcoholic methylene blue solution, and from which sections are made and examined in a glycerin methylene blue solution, indicate that along the phloem portion of each of the fibro-vascular bundles we have a chain of cells (four to six times larger than the starch-containing parenchyma cells) which contain a mucilage. They take on a deep blue color (*Fig. 7*) and occur only associated with the fibro-vascular bundles. Their position and arrangement lead to the opinion that they are in the nature of membered mucilage tubes similar to the tannin tubes of the oaks.

[1] For behavior of mucilages toward iodine compounds and other reagents, see Arthur Meyer, Wissenschaftliche Drogenkunde, S. 47 and Tschirch, *loc. cit.*, S. 206.

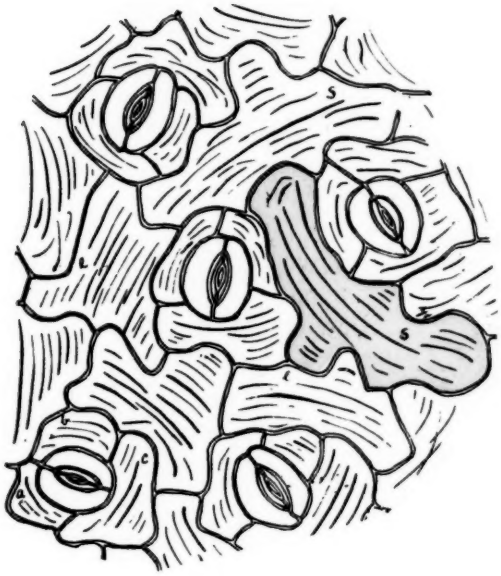

FIG. 1.

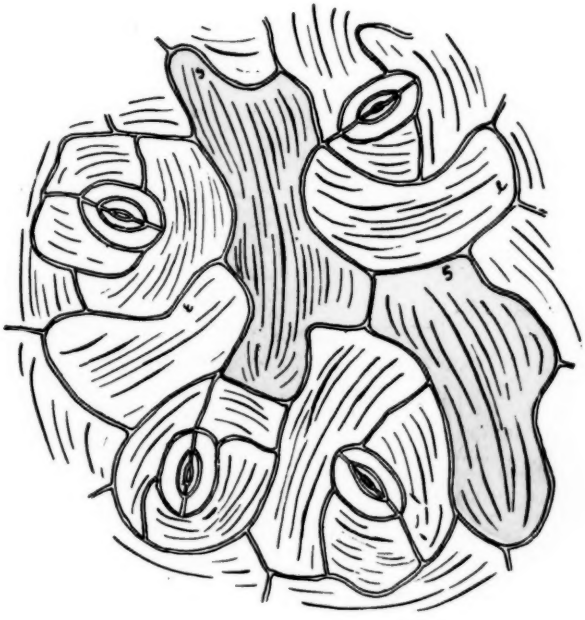

FIG. 2.

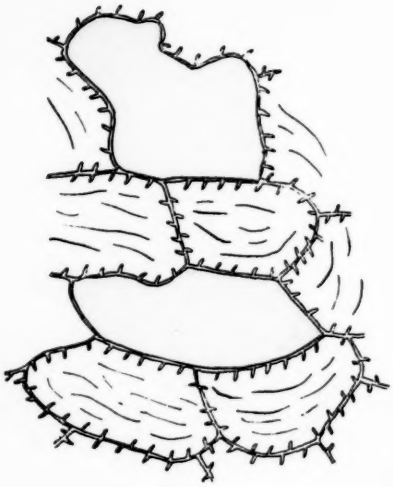

FIG. 3.

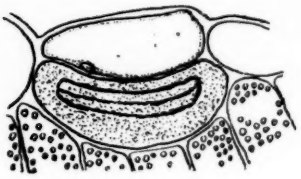

FIG. 4.

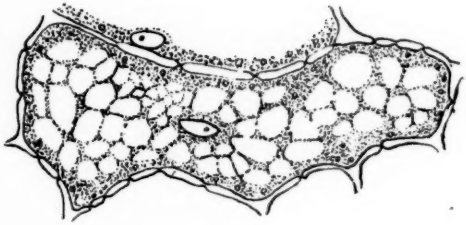

FIG. 5.

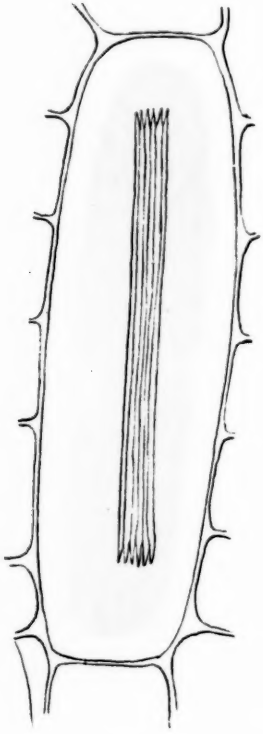

FIG. 6.

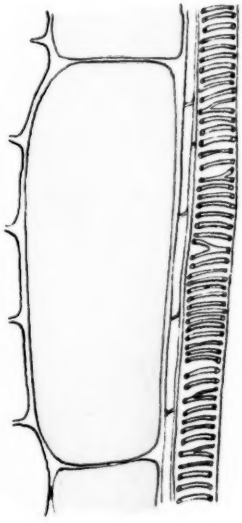

FIG. 7.

The origin of "cell-wall mucilage" may be best studied in the young roots and stems of althæa.[1] In the very young elements the mucilage cells are found to be much larger than in the surrounding parenchyma. If in this stage sections of fresh material are treated with alcohol, there is no indication of any of the cells containing mucilage. A little later, however, we find in older specimens that, in addition to the protoplasm and nucleus, there is a granular layer formed on the inside of the wall. Upon the addition of water this layer swells, and upon subjecting it to the methylene blue treatment it is found to be a mucilage layer. The cell wall grows in thickness by the successive depositions of lamallæ of mucilage, and finally in old cells we observe only a small lumen with a little protoplasm, the mucilage wall occupying the remainder.

The study of these mucilage cells may be performed on commercial specimens of althæa root. If the latter are first washed in water until softened, and then put into strong alcohol, we have material that may be easily sectioned. Sections are made and are put into an alcoholic methylene blue solution for several hours or longer. These are then mounted on a slide in a glycerin methylene blue solution. In the course of a few hours the mucilage cells have taken on a prominent blue color and are distinct from the other parenchyma cells (*Fig. 8*). The lamellæ are pronounced, and in the centre a small, irregular lumen with a small amount of protoplasm is observed.

If a specimen of elm bark of commerce is treated similarly to that of althæa root, equally, if not more, characteristic are the blue colored mucilage cells (*Fig. 9*).

Mucilage occurs as a secondary thickening beneath the cuticle of a number of seeds, as Sinapis alba (*Fig. 10*) and Linum (*Fig. 11*), etc. If sections of the dry seeds are mounted first in a solution of glycerin and water and then a glycerin solution of methylene blue added, the mucilage layer becomes a permanent blue color, stronger in Sinapis alba than in Linum.

The secretion hairs (or glands, as they are sometimes called) which we find at the apex of the divisions of the leaves of *Viola tricolor*, L., and other plants, yield a mucilage. In the leaves of *Viola tricolor*, L., at the apex of the divisions of the lamina and stipulæ, we find large

[1] See Tschirch, Anatomischer Atlas, Lief. VI, S. 128.

secretion hairs. These may possess a head-like portion alone, or may have in addition a stalk. They arise very early, especially upon the stipulæ. They serve some function in the developing lamina and then disappear. Later are formed similar hairs upon the crenate margins of the lamina. When not fully mature, the epidermal cells of the secretion hairs possess a relatively large amount of protoplasm, a large nucleus and a few rather large vacuoles (*Fig. 12*). When fully matured the secretion hair usually resembles that shown in *Fig. 13*. The upper portion or head is rounded and consists of two kinds of cells, those upon the periphery being larger and of irregular shape, those below these being smaller and nearly isodiametric. The cells of the stalk resemble closely those of the remaining portion of the leaf. The epidermis of the upper portion or head is thicker than that of the stalk and consists of lamellæ of cutin and cellulose between which, however, later arises the mucilage. If a hair that is about to discharge its mucilage is removed from the leaf and mounted in a few drops of picronigrosin or basic lead acetate solution, or glycerin methylene blue solution and slight pressure brought to bear upon the cover-glass, the cutin layer is ruptured, the mucilage is discharged, becoming faint blue with picronigrosin or methylene blue solution, or granular and almost colorless with basic lead acetate solution.

The use of methylene blue as a reagent for mucilage in plants, as outlined by the author, has the advantage that it is decisive, as only some lignified cell-walls otherwise take up this color, and it may be applied by proper manipulation to dry as well as fresh plant material.

DESCRIPTION OF ILLUSTRATIONS.

(1) Surface section of the epidermis of the under surface of the leaf of *Viola tricolor*, L.

(2) Surface section of the epidermis of the upper surface of the leaf *Viola tricolor*, L.

(3) Surface section from the under surface of the spurred petal of *Viola tricolor*, L., *var. vulgaris*, Koch.

(4) Transverse section of leaf of *Viola tricolor*, L., showing epidermal cell and sub-epidermal mucilage cell.

(5) Surface section of sub-epidermal mucilage cell of *Viola tricolor*, L., treated with alcoholic iodine and sulphuric acid solution.

(6) Longitudinal section through a commercial specimen of a fleshy scale of bulb of scilla, showing mucilage layer around acicular crystals of calcium oxalate.

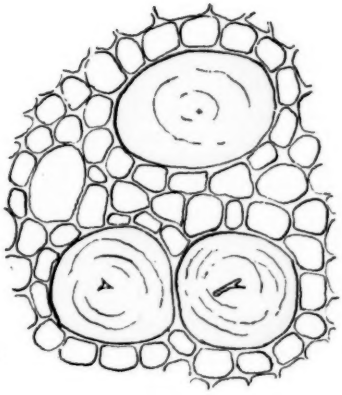

FIG. 8.

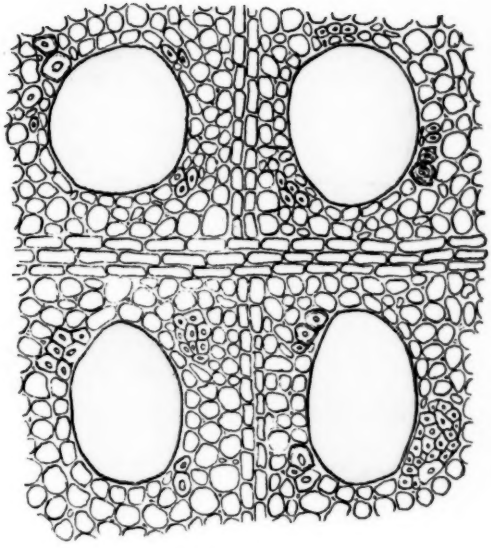

FIG. 9.

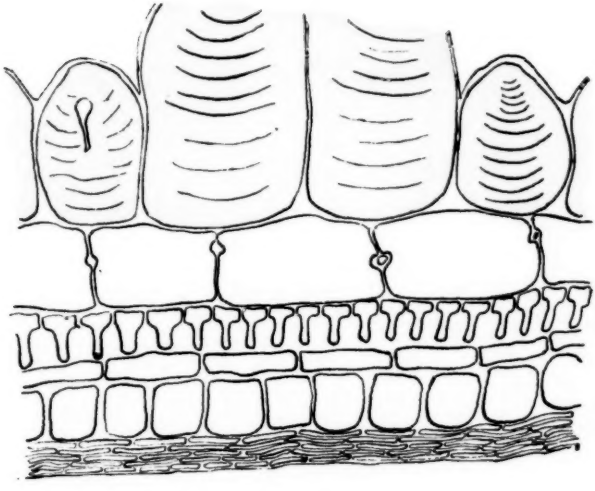

FIG. 10.

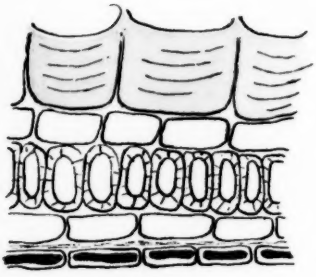

FIG. 11.

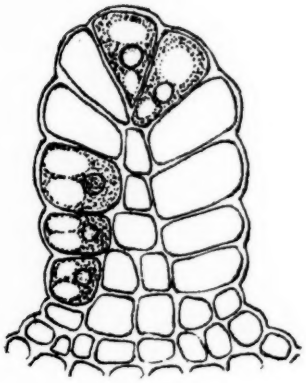

FIG. 12.

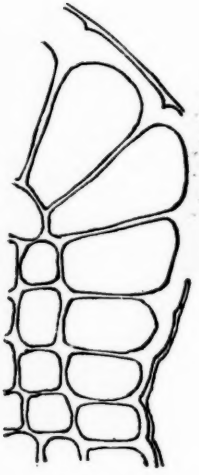

FIG. 13.

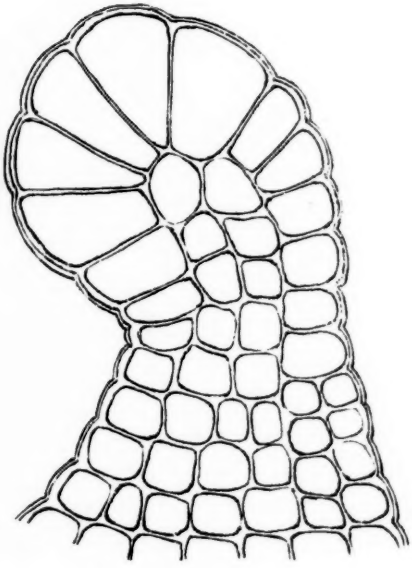

FIG. 14.

(7) Longitudinal section through the pulp of banana fruit near a fibro-vascular bundle, showing large membered mucilage secretion cell.

(8) Transverse section through a commercial specimen of Althæa root treated as described in the test, showing large mucilage cells with lamellæ and irregular protoplasmic contents.

(9) Transverse section through a commercial specimen of Ulmus treated similarly to the Althæa specimen. The large mucilage cells are surrounded by parenchyma cells containing starch and calcium oxalate crystals and a few bast fibres.

(10) Transverse section of seed coat of Sinapis alba, showing outer mucilaginous wall.

(11) Transverse section of seed coat of linum showing outer mucilaginous wall.

(12) Nearly mature secretion hair on leaf of *Viola tricolor*, L. The cells upon the periphery contain a large nucleus, protoplasm and a few relatively large vacuoles.

(13) Fully matured secretion hair on leaf of *Viola tricolor*, L., with stalk.

(14) Mature secretion hair of *Viola tricolor*, L., that was ready to discharge its mucilage. Upon mounting in a glycerin methylene blue solution or in picronigrosin and pressing upon the cover-glass with a needle or pencil, the mucilage is discharged and takes up the stain.

HYDROGEN PEROXIDE AS A FACTOR IN SPONTANEOUS COMBUSTION.

By Charles H. LaWall.

The danger of explosion of hydrogen peroxide, when kept in tightly stoppered bottles, has long been recognized as a serious drawback to the purchase of any considerable quantity at one time. The deterioration or decomposition which, in the most favorable instances, takes place to some extent after several weeks' standing in the bottled condition, is accompanied by liberation of oxygen, which (if the bottle be very tightly stoppered) accumulates until the pressure is great enough to force out the stopper or burst the bottle, the latter circumstance occasionally being attended by considerable damage to objects in the immediate vicinity.

Although a working process was included for the preparation of hydrogen peroxide in the 1890 Pharmacopœia, at the time of its admission, few pharmacists attempt to make it themselves, and its manufacture is confined to a limited number of firms who make it on a very large scale.

As transportation is very detrimental to it, and, considering the large amount of it that is handled yearly, the small number of ex-

plosions reported is to be wondered at. Probably this may be largely accounted for by the fact that it is usually the custom of the manufacturer to replace bottles broken spontaneously, and it has necessarily made him very cautious regarding the condition of the bottles and the acidity and volume strength of the preparation when it leaves his hands.

Quite recently, however, the writer's attention was attracted to a new property of this article, which property, it is believed, has never before been recorded.

It was the phenomenon of spontaneous combustion, caused by hydrogen peroxide under certain conditions. The property was investigated further, and experiments verified the conclusion that, under certain favorable conditions, hydrogen peroxide is capable of causing spontaneous combustion.

The circumstances attending it were as follows: About April 24th the writer and his assistant went botanizing in New Jersey. Neither Rhus toxicodendron nor Rhus venenata were yet in leaf nor flower, although many of the plants were observed and avoided on general principles.

The next day the assistant discovered that his right wrist was affected by Rhus poisoning, and a course of treatment was begun, using peroxide of hydrogen, which seemed to act very favorably upon the eruption. A cheesecloth bandage was wrapped about the wrist and kept saturated with peroxide by pouring on a small quantity occasionally. The treatment was discontinued in the evening, and the bandage removed before retiring. On the second day of the treatment a rush of work interfered with the previous practice of keeping the bandage constantly moistened, and, after several applications during the earlier part of the morning, the matter was entirely forgotten. Several hours later an odor of burning clothes and severe pain in the wrist directed the patient's attention to the fact that the bandage was smouldering and was already charred black in many places. Before it could be removed, it had caused several burns on the wrist, which required weeks to heal and which will show scars for several years.

The experiment was afterward repeated by saturating the same material (cheesecloth) with peroxide of hydrogen and exposing it to the heat of a drying oven, meanwhile observing the temperature and action of the peroxide. Charring took place in all cases, but in no

case was it produced at blood heat, the lowest temperature at which the action was observed being 65° C.

The conditions produced by wrapping a bandage in the manner described may lower the temperature of combustion somewhat, but as no one cared to submit himself to experiment in that direction, so the occurrence is given as it was noted, without verification.

The probable cause of the phenomenon is the presence of a slight amount of free sulphuric acid, which is allowed by the U.S.P. for the purpose of preserving the solution. When the experiment was tried with hydrogen peroxide which had previously been neutralized, little or no charring effect was produced on the material used, while a 1 per cent. solution of sulphuric acid produced charring to a greater extent than the peroxide in the first instance.

305 CHERRY STREET, PHILADELPHIA.

BELLADONNA PLASTERS.

BY CARL E. SMITH.

In the April number of this journal the writer published a paper on this subject, in which was included a report on the examination of a number of commercial plasters. The most of these were far lower in alkaloidal strength than was to be expected from any reasonable interpretation of the pharmacopœial requirements, if it be assumed that the manufacturer would follow the spirit of the Pharmacopœia by upholding the strength there indicated indirectly, even if it was found impracticable to follow it in the letter, in the substitution of extract of Scopolia root, rubber, resins, etc., for the officinal ingredients. As the officinal plaster is intended to be equal in strength to its own weight of belladonna *leaf*, and the average alkaloidal strength of this is 0·3 or 0·4 per cent., a plaster containing at least 0·3 per cent. might be insisted upon. Since the publication of the paper referred to, the writer has had occasion to assay two additional samples of commercial plasters, and found them to approach more closely to this standard than the greater part of those previously examined. They contained, respectively, 0·29 and 0·31 per cent. of alkaloids. They cannot be classed as officinal, however, since they are not made in accordance with the directions of the Pharmacopœia, but contain extract of the root (belladonna or scopolia) and rubber.

Dr. E. H. Squibb has been kind enough to call the writer's attention to some statements in the paper, that appear as if it was inferred that the officinal plaster could be made from the root as well as from the leaf, and that the alkaloidal strengths of the first three samples of the table (p. 188), from 0·4 to 0·6 per cent., were regarded as representing the standard of the U. S. Pharmacopœia. There was no intention to convey such an impression, for a strictly officinal plaster can be made only from the leaf and with a vehicle differing considerably from the rubber compositions employed by all manufacturers. The writer made use of the expression, "U.S.P. standard of strength," which is rather vague in this case, as no standard is set except that of a definite quantity of belladonna leaf containing a variable per cent. of alkaloids. In using this expression the writer left out of consideration the source of the alkaloids, meaning simply a plaster having an alkaloidal strength equal to the average alkaloidal strength of good belladonna leaf, but not necessarily made from leaf. But, since experience has shown the average to be between 0·3 and 0·4 per cent., a plaster offered as officinal, or as a substitute for the officinal, should not contain less than 0·3 per cent. of alkaloids, which is also the opinion of Dr. Charles Rice.

It is desired to correct a misstatement as to the authorship of the method of assay which has been employed in this work. Through a misconception it was credited to Mr. S. W. Williams, Ph.C., and Mr. C. E. Parker, Ph.C., as joint authors, whereas it was devised independently by Mr. Parker, but published in 1890 by Mr. Williams, and since that time modified and improved by Mr. Parker. The writer herewith apologizes to Mr. Parker for the error.

NEW YORK COLLEGE OF PHARMACY, May 13, 1898.

ATROPINE PERIODIDES AND IODOMERCURATES.[1]

BY H. M. GORDIN AND A. B. PRESCOTT.[2]

I. ATROPINE ENNEAIODIDE.

It has been known for a long time that in solutions of atropine salts, as in those of the salts of most other alkaloids, a solution of iodine in potassium iodide gives an insoluble precipitate. The nature of this precipitate has so far as we know not been thoroughly

[1] *The Journal of the American Chemical Society*, May, 1898.

[2] In the work of Research Committee D, Section II, Committee on Revision of the Pharmacopœia of the United States.

investigated. Jörgensen[3] has obtained and described two periodides of atropine; a tri-iodide and a pentaiodide. Our experience has taught us that in aqueous solutions the capacity of atropine for combining with iodine varies very widely, and the quantities taken up seem to depend upon the concentration of the liquids and even the order of mixing them.

The highest number of iodine atoms which a molecule of atropine can combine with seems to be nine; between this and the above-mentioned tri-iodide lie the other compounds of atropine with iodine which are formed in aqueous solution. The same is true when chloroform is used as a solvent. We reserve for a later date a report upon the exact conditions which are necessary for the formation of any particular periodide of atropine. For the present we wish to say that under the conditions described below we were able to obtain the enneaiodide of atropine, $C_{17}H_{23}NO_3.HI.I_8$, as the sole combination of all the alkaloid, and sufficiently stable.

These conditions are the following: The concentration of the aqueous solution of the atropine salt should not exceed five-tenths per cent.; that of the iodine solution must not exceed one per cent.; the latter has to be acidulated with some sulphuric or hydrochloric acid; the atropine solution must be added to the iodine solution and not *vice versa*, and this addition must take place in small portions at a time, shaking the mixture thoroughly after each addition. At first the liquid becomes very turbid and particles of iodine are seen to be floating upon its surface; on continued addition of the atropine solution and shaking, the iodine-colored turbidity disappears, a dark granular precipitate falls out, and the supernatant liquid becomes perfectly transparent, but is still dark-colored. If the addition of the atropine be stopped at this stage, *i. e.*, while the supernatant liquid has a very dark red color, the composition of the precipitate will be found to be that of the enneaiodide $C_{17}H_{23}NO_3HI.I_8$.

Whether additional quantities of atropine will make the precipitate take up more atropine and become a lower periodide we shall try to determine by later experiments. On the other hand, when the order is reversed and the iodine solution is added to the atropine solution, it is always a lower periodide that is formed; but whether on continued addition of the iodine the precipitate will take up more of it and become a higher periodide, we cannot say as yet.

[1] *J. prakt. Chem.*, 2, 3, 329.

The enneaiodide, obtained as described, being unstable while moist and when removed from its mother-liquor, the precipitate has to be collected quickly by means of a pump, washed a few times with cold water and dried first on porous plates and then in vacuum over sulphuric acid. As thus obtained it is a very dark brown almost black powder, quite permanent in dry air and has only a slight odor of iodine. It is very difficultly soluble in ether, chloroform, benzene or carbon disulphide, but is soluble in alcohol, very freely when hot. In cold water it is insoluble; hot water decomposes it quickly; it is also decomposed by concentrated solutions of potassium iodide. At 90° C. it commences to give up iodine vapors and at 140° C. melts to a dark liquid.

To obtain it in crystalline form it is first washed with a little cold alcohol to remove traces of free iodine and then dissolved in warm alcohol. On cooling it crystallizes out in dark-green prisms and leaflets, having the same properties as the non-crystallized body.

In this enneaiodide one-ninth of the total iodine is firmly combined just as in normal hydriodides, while eight-ninths is easily removed by reducing agents, such as sulphur dioxide and sodium thiosulphate. The compound therefore may be considered an atropine hydriodide octaiodide.

The additive iodine we estimated volumetrically and the total iodine both gravimetrically and volumetrically.

To estimate the additive iodine a small quantity of the enneaiodide is dissolved in very little alcohol, an excess of a standardized solution of sodium thiosulphate added and the excess titrated back with a standard solution of iodine, using starch as the indicator.

For total iodine the substance is covered with an excess of powdered metallic zinc and some water and then boiled gently for ten or fifteen minutes, taking care to prevent loss by spurting; the mixture is then thrown upon a filter, and the containing flask and the filter thoroughly washed with hot water. The iodine in the zinc iodide thus formed can either be estimated by precipitation with silver nitrate and nitric acid and weighing as silver iodide, or it is precipitated with an excess of a standardized solution of silver nitrate and the excess titrated back with a standard solution of ammonium thiocyanate, using ferric nitrate as indicator.

Having obtained the enneaiodide of atropine it was natural to suppose the existence of a heptaiodide, with probability of a com-

plete series from the tri-iodide to the enneaiodide. And in fact in the course of our work we once obtained this heptaiodide. But our efforts to determine the exact conditions necessary for the formation of this body have so far not been successful.

The easiest way to obtain the periodides of atropine is to use chloroform as a solvent. On adding twenty grammes atropine to a warm solution of thirty grammes iodine in chloroform (500 c.c.) the enneaiodide crystallizes out very soon in the shape of small, shining, dark-green crystals. If these be removed by filtration, the mother-liquor will give several successive crops of the dark-blue pentaiodide and at last a crop of the brownish-red tri-iodide.

II. ATROPINE MERCURIC IODIDES.

The periodides of atropine, like those of many other alkaloids, easily give double salts with mercuric iodide, obtained on shaking the alcoholic solution of the periodide with mercury and gently warming the mixture. This double iodide of atropine and mercury can also be made by mixing theoretical quantities of atropine and iodine, adding a little alcohol and an excess of mercury, slightly warming, and shaking till the color of iodine disappears. If the higher periodides of atropine be used in the preparation of this double iodide of atropine and mercury, there is always separation of mercurous iodide; but, if theoretical quantities of atropine and iodide are used, there is no separation of mercurous iodide. The formula of this double iodide of mercury and atropine, as shown by our analysis, seems to be $C_{17}H_{23}NO_3.HI.HgI_2$. It resembles in composition several other double iodides of alkaloids and mercury obtained by Groves[1] by a different method. But besides this double iodide we also obtained another having the composition $(Atrop.HI)_2.HgI_2$. It was made by treating a solution of the $Atrop.HI.HgI_2$ in diluted alcohol with an excess of potassium iodide. From the liquor obtained by shaking an alcoholic solution of atropine and iodine with mercury the monoatropine hydriodide mercuric iodide crystallizes out in shining yellow crystals, melting at 89° to 90° C., difficultly soluble in ether or chloroform, partly soluble in hot water.

The analysis for mercury and for iodine in these bodies can be made in different ways, but the best results are obtained by a modification of the method of Risse.[2] The mercury and the iodine are

[1] *Quart. J. of Chem. Soc.*, 11, 97.

[2] *Ann. Chem.* (Liebig), 107, 223.

determined in two separate portions. For mercury the substance is dissolved in a little warm alcohol and a little water added; the solution is then acidulated with a few drops of dilute hydrochloric acid and saturated with hydrogen sulphide. The mercuric sulphide is then dried and weighed in the usual way. For the determination of iodine the substance is treated with a hot solution of potassium hydroxide (1 : 10), diluted with water, filtered, and, when completely cold, neutralized with acetic acid. The iodine is now precipitated with silver nitrate and nitric acid and determined as silver iodide in the usual way.

In the following analyses the standard silver nitrate solution was made to correspond with one per cent. of iodine and the ammonium thiocyanate solution to correspond, cubic centimeter per cubic centimeter, with the silver nitrate solution. The standard solution of iodine contained 1 per cent. of iodine, and the sodium thiosulphate solution corresponded, cubic centimeter per cubic centimeter, with the iodine solution.

Analysis of the Atropine Enneaiodide not Recrystallized: Volumetric estimation for total iodine, 0.15225 gramme required 12.2 c.c. of the silver nitrate solution.

For the iodine removed by reduction, 0.19255 gramme required 13.7 c.c. of the thiosulphate solution.

	Calculated for $C_{17}H_{23}NO_3.HI.I_8$.	Found.
Iodine by reduction	70.88	71.15
Total iodine	79.74	80.13

In the gravimetric estimation from 0.218 was obtained 0.3207 silver iodide.

	Calculated for $C_{17}H_{23}NO_3.HI.I_8$.	Found.
Total iodine	79.74	79.48

Analysis of the Airopine Enneaiodide Recrystallized from Alcohol: The methods employed were the same as with the non-crystallized compound and the standard solutions of the same strength.

In the volumetric estimation of total iodine, 0.12685 gramme required 10.1 c.c. of the silver nitrate solution. For the iodine removed by reducing agents, 0.23105 gramme required 16.4 c.c. of the thiosulphate solution.

	Calculated for $C_{17}H_{23}NO_3.HI.I_8$.	Found.
Total iodine	79.74	79.62
Iodine by reduction	70.88	70.98

In the gravimetric estimation of total iodine, 0·2031 gramme gave 0·30035 silver iodide.

	Calculated for $C_{17}H_{23}NO_3.HI.I_8$.	Found.
Total iodine	79·74	79·90

Analyses of the Double Salts of Atropine Hydriodide and Mercuric Iodide: 0·2632 gramme of the monoatropine hydriodide mercuric iodide gave 0·0699 gramme mercuric sulphide, and 0·30445 gramme of the substance gave 0·24785 gramme silver iodide.

	Calculated for Atrop. $HI.HgI_2$.	Fouud.
Mercury	23·03	22·89
Iodine	43·74	43·98

Of the diatropinehydriodide mercuric iodide, 0·1798 gramme gave 0 032 gramme mercuric sulphide, and 0·257 gramme of the substance gave 0·18885 gramme silver iodide.

	Calculated for $(Atrop. HI)_2.HgI_2$.	Found.
Mercury	15·58	15·34
Iodine	39·46	39·70

III. ATROPINE ESTIMATION AS PERIODIDE.

The formation of atropine enneaiodide under the conditions described above affords a convenient method for estimating the strength of atropine solutions by means of a standard solution of iodine and titrating back with a standard solution of sodium thiosulphate. The way to operate is as follows: The atropine solution, whose strength is approximately determined by a preliminary experiment, operating in the way described below, is diluted with water so as to contain at most four-tenths to five-tenths per cent. of the alkaloid, and in so doing, the solution is made up to a given volume. Twenty or thirty cubic centimeters of a decinormal iodine solution are now put into a measuring flask holding 100 c.c., diluted with a little water, and acidulated with a few drops of diluted sulphuric acid; the atropine solution is now run in from a burette slowly, and in small portions at a time, shaking the flask thoroughly after each addition and observing whether the supernatant liquid commences to clear up. If not, a little more of the atropine solution is added, and the mixture again shaken for a minute or two. In this way the addition of atropine is slowly continued till after a few shakings the supernatant liquor commences to become transparent, still hav-

ing a dark red color, which can easily be seen by stoppering the flask, reversing it and looking through its neck. The addition of atropine is then stopped, the flask shaken till the supernatant liquid is perfectly transparent, and then it is diluted to 100 c.c. Of this liquid an aliquot portion is filtered off and the excess of iodine in it determined by a decinormal solution of sodium thiosulphate. Every part by weight of iodine consumed corresponds to 0·2849 part of alkaloid or every cubic centimeter of the decinormal iodine solution consumed corresponds to 0·0036048 gramme of atropine alkaloid.

These factors are obtained on the ground that for the formation of the atropine enneaiodide only eight atoms of iodine are supplied by the free iodine used to make the decinormal iodine solution, the ninth atom coming from the potassium iodide of that solution. The success of this method depends solely upon the atropine solution being sufficiently diluted, as otherwise a resinous mass is liable to be formed instead of a granular precipitate, and added in small portions at a time to the iodine solution, care being taken to shake the mixture after each addition and to stop the operation as soon as the supernatant liquid commences to become transparent, being still red-colored. It is easy to be guided by the very dark color, as an excess of atropine makes the liquid almost colorless. With a little care the method gives very good results, as can be seen from the following analyses.

Whether this method of assay is applicable to the crude drugs containing atropine and their galenical preparations, we shall try to determine by experiments to be continued.

In conclusion, we wish to say that the method of using a solution of iodine and potassium iodide for the quantitative estimation of alkaloids has been long since proposed,[1] and recently Kippenberger[2] has given considerable prominence to this method in his toxicological and other researches. But he rests upon the assumption of the formation of the atropine iodide, and this may be the leading product under the particular conditions he prescribes; but his method as a whole, when tried in this laboratory, has not given satisfactory results. The estimation of caffein as a periodide recently published by Gomberg[3] proves highly satisfactory.

[1] Bouchard: *Compt. rend.*, **9**, 475: R. Wagner. *Ding. poly. J.*, **161**, 40. *Ztschr. anal. Chem.*, **1**, 102.

[2] *Ztschr. anal. Chem.*, **35**, 10; **34**, 317, etc.

[3] *Jour. Amer. Chem. Soc.*, **18**, 331.

In the following estimation of the strength of atropine solutions both the iodine solution and the sodium thiosulphate solution were strictly decinormal. Of the iodine solution 20 or 25 c.c. were put into a 100 c.c. measuring flask and atropine solutions of known strength run in from a burette and the operation continued as described above. When the supernatant liquid was perfectly transparent, the flask was filled up to 100 c.c. and 50 c.c. were filtered off. In these 50 c.c. the excess of iodine was determined by means of the tenth-normal thiosulphate solution and the strength of the atropine solutions calculated by using the factor 0.0036048 for every cubic centimeter of decinormal iodine used up.

No. of sample.	Number of c.c. of the atropine solution taken.	Number of c.c. of the tenth-normal iodine used up.	Calculated strength. Per cent.	Actual strength. Per cent.
1	12	15.6	0.47	0.50
2	15	14.9	0.36	0.40
3	17	13.2	0.28	0.30
4	12	10.0	0.28	0.25

We shall try to determine experimentally whether this method is also applicable to other alkaloids and their galenical forms.

The above-mentioned factor for every cubic centimeter of the decinormal iodine solution was deduced as we said upon the ground that only eight atoms of iodine of every molecule of the atropine enneaiodide are furnished by the free iodine of the iodine solution—the ninth atom forming the normal iodine of the enneaiodide coming from the potassium iodide.

That this is really so has been admitted by almost all chemists in the case of all other periodides whose constitution is similar to that of the atropine enneaiodide. It would, therefore, seem to be superfluous to prove experimentally the correctness of this view with regard to the enneaiodide of atropine. But owing to the fact that Kippenberger in the above-cited articles advances a different view, we thought it advisable to prove irrefutably that the iodide of potassium of the iodide solution takes an active part in the reaction by which the atropine enneaiodide is formed and gives off an amount of iodine which is just equal to the amount of the normal iodine of the enneaiodide.

We proceeded in the following manner: We first determined the strength of our iodine solution with regard to free iodine; this was done by means of a sodium thiosulphate solution of known strength. We then took 10 c.c. of this iodine solution and determined the total

amount of iodine, free as well as bound to potassium, by shaking them in a flask with an excess of powdered metallic zinc till the color of iodine disappeared, filtering the solution of zinc iodide and potassium iodide thus obtained, washing the flask and the excess of zinc with hot water and precipitating the iodides in the filtrate with silver nitrate and nitric acid. From the weight of silver iodide, washed and dried in the usual way, we calculated the amount of total iodine present in our iodine solution. By subtracting the amount of free iodine from that of the total iodine, we obtained the amount of iodine present in our solution as potassium iodide. We thus found that the iodine solution contained 1 per cent. free iodine and 1·2312 per cent. combined iodine.

We then put 40 c.c. of this iodine solution in a 100 c.c. measuring flask, added 20 c.c. of a three-tenths per cent. solution of atropine alkaloid, and, after shaking well, diluted the liquid in the flask to 100 c.c. We now took two vials and in each filtered off 25 c.c. from the flask. In the first vial the amount of free iodine titrated back with sodium thiosulphate was found to be 0·0465. From this it is easy to deduce that the 20 c.c. of the three-tenths per cent. atropine solution consumed 0·214 gramme of the free iodine. In the second vial the total iodine was determined in the same way as described above and the quantity of silver iodide was found to be 0·3023 gramme, which shows that after the treatment with atropine the liquid contained 1·633 per cent. total iodine. From these data we deduce that the 20 c.c. of the atropine solution have taken up 0·02528 gramme iodine from the bound iodine. As the 20 c.c. of atropine solution contained 0·06 gramme atropine we find for 100 parts of precipitated enneaiodide

	Found. Per cent.	Calculated. Per cent.
Atropine	20·05	20·26
Iodine taken from the free iodine of the iodine solution	71·50	70·88
Iodine from the iodine bound as KI	8·45	8·86

We see that in aqueous acidulous solutions the potassium iodide takes an active part in the reaction by joining in a yield of hydriodic acid for the normal hydriodide of the alkaloid, necessary to hold the additive iodine of the periodide. When carbon disulphide or carbon tetrachloride is used as solvent for the atropine and the iodine, no periodide seems to be formed, possibly for the reason of there being

no generation of hydriodic acid for the making of hydriodide. As to the formation of the periodides in chloroformic solutions of atropine and iodine, it might possibly be explained by the substituting action of iodine either upon the chloroform or upon a side-chain of the atropine.

The direct substitution of iodine for some of the hydrogen in these bodies might, in this case, be made possible by the presence of the natural base which combines with the hydriodic acid, when formed by such a substitution. Part of the atropine would then act in a manner similar to that of mercuric oxide, which is usually employed in the iodizing of hydrocarbons. An analogous case we have in the easy substitution of iodine for some of the hydrogen in aniline, a part of which combines with the hydriodic acid, which is set free through the substitution of iodine for hydrogen in another part. At any rate we shall endeavor to determine the by-products formed when atropine enneaiodide is produced in chloroformic solutions.

UNIVERSITY OF MICHIGAN, February 28, 1898.

SODIUM PHOSPHATE SOLUTION.[1]

BY JOSEPH W. ENGLAND,
Philadelphia Hospital, Philadelphia.

The limited solubility of the official "crystallized" sodium phosphate—about 10 grains to the fluidram of water, at ordinary temperature—and the much less solubility of the "dried and powdered" salt of commerce—often used—which is the crystalline salt minus its 60·3 per cent. of water of crystallization, has militated somewhat against the more extended employment of the compound, although its use has rapidly grown in recent years. The so-called "granular" form is more convenient to handle than the crystalline, but it contains almost as large a percentage of water, and, as efflorescence of salt readily takes place on exposure to air, water is lost, and the percentage of active ingredient becomes indefinite.

The advantage in using the dried and powdered salt rests in the fact that it contains only about 1 per cent. of water, and loss of water, if any, is within very narrow limits.

Various formulas have been proposed for making solutions of

[1] Read by invitation before the Philadelphia County Medical Society, May 11, 1898.

sodium phosphate. The one most generally employed is that of a "solution of citro-phosphate of sodium," originated by William C. Wescott (AMERICAN JOURNAL OF PHARMACY, 1896, 256), as a result of his analysis of a widely-advertised proprietary preparation, claimed by the manufacturers to contain, in each fluidram, 85 grains of combined sodium phosphate, citric acid, and sodium nitrate.

Wescott's formula is as follows:

Sodium phosphate, crystals	7 ozs. (Troy) 290 grains.
Citric acid	475 grains.
Sodium nitrate	73 grains.
Water, a sufficient quantity to make	8 fluidounces.

Triturate the salts and acid until they liquefy, and add the water.

Now, it will be noticed that, in this formula, the proportion of citric acid used to *anhydrous* phosphate is very large, relatively, *i.e.*, about one-third. Three thousand six hundred and fifty grains of crystalline salt would yield 1,449 grains of anhydrous salt, and for this 475 grains of citric acid is directed.

The question that naturally arises at this point is, "What chemical change ensues in the making of this preparation?" In the writer's opinion, part of the official sodium phosphate, or acid phosphate, is changed into sodium diacid phosphate, and sodium citrate according to the following reaction:

$$\underset{1071.96}{3Na_2HPO_4.12H_2O} + \underset{209.5}{H_3C_6H_5O_7.H_2O} =$$

$$\underset{359.4}{3NaH_2PO_4} + \underset{257.54}{Na_3C_6H_5O_7} + \underset{664.52}{37H_2O}.$$

If this theory be correct, it will be seen that a part of the sodium phosphate is changed to sodium citrate. Assuming that the reaction given is correct, it will be found by equation that, in the 8 fluidounces of solution, 475 grains of citric acid are changed to 584 grains of sodium citrate, or about 9 grains of the latter to each fluidram.

The question that we, as pharmacists, should like to ask of you, as physicians, is this, "Whether or not the presence of sodium citrate and of sodium nitrate is ever contraindicated, therapeutically, when the use of sodium phosphate is indicated?" If they are, then a formula should be devised, whereby this objection shall be eliminated.

For more than a year past, the writer has used in the Philadel-

phia Hospital a formula which he thinks overcomes such an objection, if it exists. The following is the formula used, slightly increased in proportion of ingredients over original formula:

Sodium phosphate, dried and powdered . . . . . 3 ozs. (Troy) 96 grs.
Acid, phosphoric (50 per cent.) . . . . . 1½ fl.-ozs. (921 grs.)
Water, a sufficient quantity to make . . . . . 8 fluidounces.

Dissolve the solids in the water, which has had the acid previously added to it, and filter through paper.

Especial care should be taken to use the nearly anhydrous "dried and powdered" sodium phosphate, and *not* the "granular" salt with its 57 per cent. of water, or the resulting preparation will be excessively, and possibly dangerously, acid. If desired, the 85 per cent. acid, of the U.S.P., '90, may be used in place of the 50 per cent., employing a proportionately less quantity (*i. e.*, 542 grains). The 85 per cent. acid should be always weighed, however, and not measured, in order to ensure greater accuracy. Its great density increases possibility of error in measuring, unless checked by weighing.

The dose of this preparation of sodium phosphate is one to two teaspoonfuls in a wineglassful or more of water, preferably hot, three times a day, one hour before eating. If taken cold it may be made very acceptable by the addition of about ten grains of sodium bicarbonate (baking soda), when effervescence of carbonic acid gas ensues, and a grateful vichy-like solution results. If the volume of the dose be objected to, a teaspoonful or more of the solution diluted with an equal volume of water may be given, followed by the wineglassful or more of water. But, on therapeutic grounds, a relatively larger volume of water should always be given coincidentally with the dose.

As thus made, the solution of sodium phosphate is a clear, transparent, faintly acid liquid, slightly heavier than official syrup, having a cooling saline taste, mixing with water unchanged in all proportions, remaining liquid at ordinary temperature, and yielding to each fluidram, on evaporation to thorough dryness, about thirty grains of anhydrous salts.

In the making of the solution, the writer believes that the following chemical re-action takes place, in part:

$$\underset{141.8}{Na_2HPO_4} + \underset{97.8}{H_3PO_4} = \underset{239.6}{2NaH_2PO_4}$$

In other words, the official sodium acid phosphate becomes par-

tially sodium diacid phosphate—just as occurs, probably, in following Wescott's formula—while the larger proportion remains the official sodium acid phosphate, but with the difference that *no* sodium nitrate or citrate is present, or is formed.

Clinical results have shown that no difference in effectiveness results from the presence of the diacid salt with acid salt. If any objection existed to this, it could be readily met by the addition of sodium bicarbonate to each dose—as suggested above—whereby the diacid salt is alkalinized to the official acid salt.

The official sodium phosphate in solution, while chemically an acid salt—in that its molecule contains replaceable basylous hydrogen atoms—is physically alkaline in re-action. On the other hand, the diacid sodium phosphate is acid both chemically and physically, while the remaining salt of the group of orthophosphates—the normal sodium phosphate—is alkaline in re-action, and its solution, exposed to air, absorbs carbon dioxide to yield sodium carbonate and the acid phosphate.—*Philadelphia Polyclinic.*

GLEANINGS FROM THE MEDICAL JOURNALS.

By Clement B. Lowe, M.D.

SECRET REMEDIES.

The Berlin correspondent of the *Medical News* writes: "It is forbidden to sell *secret remedies* in Germany, and the Ministry of Commerce and Industry has just announced for the guidance of the courts what is meant by a secret remedy. This will remove the last loophole of the patent-medicine people, for, taking advantage of discordant legal decisions, they have been able to keep certain preparations on the market. All remedies not sold under a *prescription* from a doctor must have the formula of its contents printed on the label. This formula (and here is where the new instructions define the law) must be written, not in Latin, but, when possible, in the vernacular. It must be intelligible, not only for a doctor or pharmacist, but for any one who wishes to buy, and it must be sufficient to enable a buyer to decide whether the ingredients contained therein are such as may be reasonably expected to give relief, and whether he is paying a not unreasonable price for the amount of the different drugs which are being bought. As the merit of the

invention (if there is any) is the method of composition of the remedy, this need not be given if there is a real discovery in it, so that the inventor does not lose the benefit of his idea. This decision would strike one as a thoroughly common-sense way of dealing with a difficult question, and one calculated to eradicate the immense swindle patent medicines usually involve. Quousque tandem? How long, then, before Americans will be able to point to some such sensible law?"

There are advantages in a paternal form of government after all.

COCAINE POISONING.

The *Lancet* gives an account of a man of forty years who took ten grains of cocaine hydrochlorate by mistake, and an hour afterwards anesthesia developed. The eyeballs protruded and were immobile, the pupils semi-dilated and fixed. Expiratory dyspnea ensued, respiration sinking to 8 per minute. The pulse was strong, 120 per minute. Strychnine and digitalin caused immediate improvement, and the symptoms passed off within eight hours.

FOR CHRONIC CYSTITIS.

R.	Guaiacol,	75 grains.
	Iodoform,	1 dram.
	Sterilized olive oil,	3 fluid ounces.

For injection into the bladder.—G. COLLIN, *Phila. Med. Jour.*, April 9, 1898.

FOR ULCERS OF THE LEG.

R.	Carbolic acid,	30 grains.
	Boric acid,	2½ drams.
	Powdered camphor,	2 drams.
	Ichthyol,	5 drams.
	Oil of sweet almonds,	2½ drams.
	Zinc ointment,	3 ounces.

Apply topically.—ELDEN, *Phila. Med. Jour.*, April 8, 1898.

HOMEOPATHY IN BAVARIA.

At a recent meeting of the Financial Committee of the Bavarian Parliament, Herr Landmann proposed that a University Chair of Homeopathy should be established in the University of Munich. The Minister replied that the University to which the question had been referred had replied that the need of such a chair was not felt, inasmuch as homeopathy was not a science. A similar incident, which ended in a like manner, occurred not long ago in the Wurtemberg Landtag.—*Brit. Med. Jour.*

A STATE MEDICAL LAW UPHELD.

The United States Supreme Court at Washington recently affirmed the constitutionality of the act of the New York Legislature of 1895, prohibiting persons who have been convicted of, and punished for, a crime from practising medicine in the State, the opinion being delivered by Judge Brewer.—*Med. News*, April 30, 1898.

FEEDING OF INFANTS.

According to *Pediatrics*, there is a law in France forbidding the giving of solid food of any kind to infants under one year of age without the written consent of a physician. The use of feeding-bottles with long rubber tubes is also forbidden by law.

FOR GASTRO-INTESTINAL CATARRH.

In cases in which opiates are not indicated, Liebrich recommends the following mixture for the diarrhœa:

℞ Tinct. Calumbæ,
Tinct. Cascarillæ, } āā ℥ss

M.—Sig: Twenty drops, 4 or 5 times daily.—*Med. News*, April 30, 1898.

FOR URTICARIA.

℞ Menthol, gr. xl
Chloroform,
Aetheris,
Spts. Camphoræ, } āā ℥ii

M.—Sig: For external use as a spray or lotion. The affected part should then be dusted with powdered starch or oxide of zinc.—*Med. News*, April 30, 1898.

THE AMERICAN HOSPITAL AT TEHERAN.

The hospital conducted by the Presbyterian missionaries from this country to Persia has received a gift of more than $1,000 from Persian officials and the European colony, including Russians and Turks. The American Minister, Hon. Arthur Sherburne Hardy, organized an entertainment or concert with the help of the Persian Prime Minister and a number of the diplomatic corps, by which so marked a success was achieved that the Shah requested a repetition of it at his palace. The Shah himself attended the second concert, and his distinguished guests were entertained at its close, on his behalf, and further donations to the hospital were received by several Persian magnates.—*Medical News.*

RECENT LITERATURE RELATING TO PHARMACY.

THE SACCHARINE AND ASTRIGENT EXUDATIONS OF THE "GREY GUM" EUCALYPTUS PUNCTATA.

Henry G. Smith (*Proc. Royal Soc. of N. S. Wales*, **31**, 177) has found several substances exuding from the bark of the Grey Gum. This exudation was caused by the puncture of an insect, and the character of the product depends upon the following:

(*a*) When the puncture has *not* penetrated entirely through the bark and a flow is set up, the exudation is quite white and consists largely of raffinose (melitose).

(*b*) When the puncture has just penetrated through the bark, the product is contaminated with tannic acid and eudesmin, showing that eudesmin is present in the cells of the tree with tannic acid.

(*c*) When the puncture or boring of the larva has continued into the wood of the tree, pure kino is produced, providing the sugary sap of the bark is not exuding at the same time.

This indicates that the kino is not obtained from the bark directly, but from the wood of the tree. The bark does not contain tannin, but consists principally of the sugar raffinose. The saccharine exudation was examined by Mr. Smith, and determined to be practically identical in composition with the ordinary and well-known Eucalyptus manna. It was found to consist very largely of raffinose and a small quantity of reducing sugars.

The darker saccharine exudation obtained when the puncture just penetrated through the bark contained raffinose, tannin and anhydrides, eudesmin, eucalyn and an easily fermentable reducing sugar.

The astringent exudation obtained when the puncture penetrated the wood was found to belong to the "turbid groups" of Eucalyptus kino. The crystalline substance contained in it was determined by the method previously adopted for the extraction of these new bodies, *eudesmin* and *aromadendrin*, from Eucalyptus kino (See *Proc. Royal Soc. N. S. Wales*, 1895, page 32, and AM. JOUR. PHAR., 1895, page 575). The product obtained in the present case was eudesmin. Aromadendrin could not be detected in this kino, so so that now it is possible to divide the "turbid group" of kinos into three sub-groups, based on a chemical classification, viz., (*a*) those that contain aromadendrin alone, of which E. calophylla is a representative; (*b*) those that contain eudesmin alone, of which E. punc-

tata is a type; and (*c*) those containing both eudesmin and aromadendrin, of which E. hemiphloia is characteristic. In the kino under consideration the following constituents make up the whole of the product:

Tannin and its derivatives	66·05
Eudesmin	4·45
Moisture	16·20
Ash	0·72
Debris (or residue), wood, bark, etc.	12·36
	99·78

In connection with this work, and in the same paper Mr. Smith records the separation from some of the Eucalypts belonging to the Renantheræ, of a yellow dye allied to quercetin. For this substance he suggested the name of *mystycolonin*. It was separated in considerable quantity from the leaves of E. macrorhynca. The existence of this substance in the leaves of this species was announced by J. H. Maiden, in 1887. It bids fair to become of commercial value and rival the well-known yellow dye quercitrin.

WEIGHT AND SPECIFIC GRAVITY OF WHEAT GRAINS.

A. Schischkin, on the variations in the quality of wheat grains (*Deutsch. Landw. Presse*, 1897, p. 909), has determined the specific gravity, absolute weight and nitrogen content of nineteen samples of one variety of wheat grown under systems of rotation without the application of fertilizers. The samples represented nineteen different seasons. It is shown that the absolute weight of wheat grains varies considerably in different seasons, but that the specific gravity remains comparatively constant. The nitrogen content varied from 2·205 per cent. in 1882 to 3·173 per cent. in 1891. No connection is believed to exist between the nitrogen content and the absolute weight. The samples from the smaller yields were characterized by a high nitrogen content.

Glauber Salts in the Caspian Sea.—Russian chemists have recently been investigating a salt deposit found in the Bay of Kara-Bougos, an inlet of the Caspian Sea, on the eastern shore, nearly opposite Baku. The bottom of the bay was found to be covered with a crust of crystallized Glauber salt, in many places 1 foot thick. The waters of the Caspian Sea are very salt, and in the bay named, which is nowhere 50 feet deep, evaporation goes on very rapidly. As fuel can readily be obtained from Baku, and transportation by water can be used, it is proposed to establish a factory to make sodium sulphate on a large scale.—*Engineering and Mining Journal*, March 12, 1898.

EDITORIAL.

THE BRITISH PHARMACOPŒIA, 1898.

The announcement, that copies of the new edition of the British Pharmacopœia are about ready for distribution is received with considerable interest by the pharmacists of the United States as well as those in Great Britain. Pharmacopœias reflect not only the progress of medicine and pharmacy in the country in which they are published, but show in a certain measure to all countries the present status of these professions. The English pharmaceutical journals have contained, since January 8th of this year, many references to the new Pharmacopœia, so that the general principles of this work are well known. About the middle of April advance copies were received by the British medical and pharmaceutical journals, and the latter are full of information on the nature and scope of the revision. Our knowledge of the new Pharmacopœia is necessarily from these sources.

The last edition of the British Pharmacopœia was in 1885. The work upon the new edition was begun about four years ago. Professor Attfield has acted as editor, and upon the Revision Committee have been nine physicians, eleven practical pharmacists and eight experts. This has been the first time that practical pharmacists have been invited to share in the work of the committee. We shall endeavor to mention briefly some of the striking features of the new British Pharmacopœia :

I. From a pharmaceutical standpoint, a number of innovations have been made, among which may be mentioned :

(*a*) The metric system has been introduced. All quantities used in the making of preparations are stated in terms of both Imperial and Metric systems. Imperial measures are (according to the *Chemist and Druggist*, 1898, p. 627) standardized at 62° F. and metric measures at 39·2° F. The quantities under "Characters and Tests," and in all analytical quantitative processes, are stated in the metric system only.

(*b*) The old proof spirit (Spiritus Tenuior) has been abandoned, and instead, under Spiritus Rectificatus, are given five different strengths of alcohol, viz.: 90 per cent., 70 per cent., 60 per cent., 45 per cent. and 20 per cent. Absolute alcohol is retained.

(*c*) The use of glycerin in the making of tinctures has been retained for Tinctura Kino, and extended to one other preparation, viz., Tinctura Rhei Composita, where it is added after filtering the percolate. It is added also in Extractum Sarsæ Liquidum, Tinctura Chloroformi et Morphinæ Composita and in Syrupus Pruni Virginianæ, a new preparation in the revision.

(*d*) In regard to the processes of percolation and maceration in the preparation of tinctures, it is to be noted that in both operations the marc is still submitted to pressure. In the maceration process there is no adjustment of the final bulk of preparations save in preparations like Tinctura Aloes, Tinctura Asafetidæ, etc.

(*e*) The principle of standardization of galenicals has been applied to Belladonna and Ipecac preparations in addition to those already mentioned in the 1885 Pharmacopœia, viz.: Cinchona. Jalap, Nux-Vomica, Opium and Pepsin.

(*f*) Under Liquors are added nine concentrated preparations of vegetable

drugs. These are in the nature of concentrated tinctures and infusions, the latter containing sufficient alcohol to preserve them.

(*g*) There is a marked change in the strength of some well-known preparations, in order, it is said, to establish, at least in some cases, more uniformity in doses. Tinctura Aconiti, Aqua Chloroformi and Suppositoria Morphinæ are reduced to about one-half the strength of those in the 1885 Pharmacopœia. Tinctura Nucis Vomicæ and Tinctura Podophylli are doubled in strength, and Tinctura Chloroformi et Morphinæ Composita is four times as strong as the same of the previous edition.

(*h*) Many of the articles and preparations have suffered some change in orthography, as Creosotum for Creasotum, Asafetida for Asafœtida, Aloinum, for Aloin, etc.

II. In the chemistry of the Pharmacopœia are numerous changes, notably in nomenclature. The "ide" termination of the salts of the alkaloids has been adopted, as Apomorphinæ hydrochloridum for A. hydrochloras, etc. "In defining substances," according to the *Pharmaceutical Journal and Transactions*, 1898, p. 394, "corrected data are given for many of the physical characters, and the nomenclature now used by chemists to indicate constitution has been adopted in some instances. Thus, the alkalies and analogous substances are now termed hydroxides; alcohol is named ethyl hydroxide; but the principle is not extended to ammonia or carbolic acid, which is now distinguished by the name phenol, or to water, for which the familiar name is retained without any reference to its chemical constitution. The acids are now described as hydrogen salts, and in some instances the constitution is illustrated by formulæ, the other salts of particular acid radicles being distinguished according to the metal or base they contain, as sodium acetate, calcium acetate, atropine sulphate, and so on. These innovations apply only to the vernacular names, and not to the Latin titles, of which the new names are synonyms rather than translations."

III. In regard to the botany and pharmacognosy we understand that there are marked evidences of progress, but that there are no very marked changes in nomenclature. *The Pharmaceutical Journal and Transactions*, 1898, p. 390, says: "The botanical names of plants yielding drugs in the 1898 Pharmacopœia have, with a few exceptions, been brought into accordance with the 'Index Kewensis,' and many of the illustrations referred to have been selected from more readily accessible works than hitherto. In some cases alterations of the official name have been made, for which there is no evident reason, such as Ipecacuanhæ Radix for Ipecacuanha, Cascarilla for Cascarillæ Cortex, and Linum for Lini Semina. The wording of the descriptions and of the characters and tests has, in the majority of cases, been modified, so as to more carefully limit the quality of drugs to be used. Details concerning the more important microscopical characters of drugs have been added, and in over twenty instances the limit of ash has been given, apparently with the view of assisting in the detection of the adulteration of powdered drugs." We also observe the statement by F. H. Alcock (*Ibid.*, p. 422), that "the introduction of the process of sterilization seems to be the first step towards the complete study of bacteriology."

It will be seen that the British Pharmacopœia, 1898, contains many novel features, some of which at least, if not all, are in accord with the modern

sciences and practice of medicine. Some of the changes, however, may be questioned as those in strength of well-known preparations. But there are also changes which represent the results of studies and researches that have been confirmed and with which there ought to be a unanimity of expression, as the introduction of the metric system. Some will object to the new Pharmacopœia, doubtless, because it is not permeated with sufficient material that is required in everyday practice, and may say that it does not represent the professions of to-day. It must be borne in mind that the research and practice of to-day is always a step in advance of the knowledge that is accepted. There always must be the experimental or "scouting" party in search for new truths, and these are the results that are apt to be upon every tongue, and in every office and shop, and ofttimes uppermost in the minds of those who are engaged in daily practice of the professions. But these things with their reports neither represent truth nor definite knowledge, nor anything that is certain and ought to be made pharmacopœial. This distinction can only be given these reports when this knowledge has been shaped into something definite and certain, and has been repeatedly confirmed by others.

There are some who expect the Pharmacopœia to be perfect in every respect, but they will find it like themselves, imperfect, at least, in some things. We must recognize that Pharmacopœias serve primarily as a standard, a guide, according to which every one, for whom it is intended and is competent, can make similar preparations of approximately the same strength, and so on. We expect progress in the new Pharmacopœia over preceding issues. As to whether all has been omitted, incorporated or changed in the new British Pharmacopæia that might have been, requires the careful survey of a thoughtful and practical mind from the rather lofty summit of experience.

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

HANDBUCH DER ORGANISCHEN CHEMIE. VON F. BEILSTEIN. Dritte Auflage. 88 te Lief. (Band IV, Lief 12). Hamburg und Leipsig, Verlag von Leopold Voss. 1898.

In this Lieferung (pages 705 to 714 inclusive) is contained the derivates of the following acids: $C_nH_{2n-4}O^4$; $C_nH_{2n-6}O_4$ — $C_nH_{2n-20}O_4$; $C_nH_{2n-22}O^4$ — $C^nH_{2n-24}O_4$; those with 5, 8, 9 and 10 atoms of oxygen; derivatives of the acids of the Furan series; sulfonacid derivatives of phenylhydrazin; phenylhydrazino acids. Also cyan derivatives of phenylhydrazin; phenylhydrazine derivatives of aldehydes; and derivatives of ketone.

ROYAL BOTANIC GARDENS. BULLETIN OF MISCELLANEOUS INFORMATION. Trinidad. Vol. III, Part IV, No. 14. Edited by the Superintendent Royal Botanic Gardens, J. H. Hart, F.L.S. Trinidad: Printed at the Government Printing Office, Port of Spain. 1898.

This bulletin contains articles on "Minor Industries"; Fermentation; Parasitism in the Scrophularineæ; Ustilago Maydis, D. C.; Oranges (the bitter and the sweet) and variations from the seed; an Estimation of the Characters of three Varieties of Cacao; and note on the agricultural exhibition.

AN EPHEMERIS OF MATERIA MEDICA, PHARMACY, THERAPEUTICS AND

COLLATERAL INFORMATION. By E. R. Squibb, E. H. Squibb and Charles F. Squibb. Vol. V, No. 1, January, 1898. Brooklyn, N. Y. 1898.

Owing to the absence of Dr. E. R. Squibb in Europe this number contains brief comments on the Materia Medica, Pharmacy and Therapeutics of the Year ending October 1, 1897, by Dr. E. H. Squibb. This is a record of information on the prominent features of these subjects during the past year. We find a wide range of subjects treated, as the use of acetic acid as a menstruum; the outlook for camphor; the commercial history of rhubarb; the uses of formalin; the status of antitoxin, and the therapeutical value of the newer synthetic products; the application of Roentgen rays to medical use, etc.

THE BRITISH PHARMACOPŒIA, 1898. Formulæ and Processes—Alterations, Additions and Omissions. Second Edition. *Pharmaceutical Journal* Reprint. 1898.

This is a summary sufficiently full of details concerning all medicinal preparations in the British Pharmacopœia, 1898, to enable the reader to appreciate fully the extent of the alterations in and additions to existing official preparations. It will be seen, on comparing these notes with the 1885 edition, that the majority of the older formulæ, processes, doses, etc., have been modified to a greater or less extent.

The following are some of the changes that may be noted:

Aqua Chloroformi.—2·5 c.c. in 1,000 c.c.

Extractum Belladonnæ Alcoholicum.—contains 1 per cent. of the alkaloids of the root.

Extractum Opii Liquidum.—Each 100 c.c. contains 0·75 gramme of morphine.

Injectio Apomorphinæ Hypodermica.—Each 100 c.c. contains 1 gramme of apomorphine hydrochloride.

Pilula Phosphori.—Each 100 grammes contains 2 grammes of phosphorus.

Suppositoria Morphinæ.—Each suppository contains ¼ gramme of morphine hydrochloride.

Syrupus Ferri Iodidi.—1 grain of ferrous iodide in each 11 minims.

Tinctura Aconiti.—1 gramme of aconite root for 20 c.c. of tincture.

Tinctura Belladonnæ.—In each 100 c.c. there is 0·048–0·052 gramme of alkaloids of the root.

Tinctura Chloriformi et Morphinæ Composita.—In each 10 minims there is ¾ minim of chloroform, ½ minim of diluted hydrocyanic acid and $\frac{1}{11}$ grain of morphine hydrochloride.

Tinctura Cinchonæ.—Each 100 c.c. contains 1 gramme of alkaloids.

Tinctura Cinchonæ Composita.—Each 100 c.c. contains 0·5 gramme of alkaloids.

Tinctura Jalapa.—Each 100 c.c. contains 1·5 gramme of resin.

Tinctura Nucis Vomicæ.—Each 100 c.c. contains from 0·24 gramme to 0·26 gramme of strychnine.

Tinctura Podophylli.—Each 100 c.c. contains 3·65 grammes of resin.

Tinctura Quininæ.—Each 100 c.c. contains 2 grammes of quinine hydrochloride.

Tinctura Quininæ Ammoniata.—Each 100 c.c. contains 2 grammes of quinine sulphate.

Tinctura Strophanthi.—2·5 grammes of strophanthus seeds for 100 c.c.

Trochiscus Bismuthi Compositus.—Each contains in grains of bismuth oxycarbonate, 2; heavy magnesium carbonate, 2; precipitated calcium carbonate, 4.

Trochiscus Potassii Chloratis.—Each contains 3 grains of potassium chlorate.

Trochiscus Sodii Bicarbonatis.—Each contains 3 grains of sodium bicarbonate.

Unguentum Acidi Carbolici.—Each 100 grammes contains nearly 4 grammes of phenol.

Unguentum Acidi Salicylici.—Each 100 grammes contains 2 grammes of salicylic acid.

Unguentum Aconitinæ.—Each 100 grammes contains 2 grammes of aconitine.

Unguentum Atropinæ.—Each 100 grammes contains 2 grammes of atropine.

Unguentum Belladonnæ.—Each 100 grammes contains 0·6 gramme of the alkaloids of belladonna root.

Unguentum Cantharidis.—10 grammes of cantharides per 100 grammes of ointment.

Unguentum Creosoti.—Each 100 grammes contains 10 c.c. creosote.

Unguentum Gallæ cum Opio.—Each 100 grammes contains 7·5 grammes opium in very fine powder.

Unguentum Hydrargyri Compositum.—Each 100 grammes contains 40 grammes Unguentum Hydrargyri.

Unguentum Hydrargyri Nitratis Dilutum.—Each 100 grammes contaius 20 grammes Unguentum Hydrargyri Nitratis.

Unguentum Hydrargyri Oxidi Rubri.—Each 100 grammes contains 10 grammes of red mercuric oxide.

Unguentum Sulphuris Iodidi.—Each 100 grammes contains 4 grammes of sulphur iodide.

Unguentum Veratrinæ.—Each 100 grammes contains 2 grammes of veratrine.

SEMI-ANNUAL REPORT OF SCHIMMEL & CO.—Leipzig and New York. April, 1898.

This report is somewhat briefer than customary, owing to the fact that fewer scientific researches have been accomplished in the examination of ethereal oils, during the last six months than usually. The Report adds, that "it would, however, be a mistaken inference to conclude that the realm of knowledge has been so far advanced as to admit a pause in the work of further research. On the contrary, many and important problems still remain to be solved, but it should be borne in mind that with the extended and deeper insight into the constitution of so highly complex organic compounds, the difficulties of further and accurate research, and of correct interpretation accumulate and sometimes necessitate a discriminating retrospect upon disjointed or unclassified scientific material." Among "novelties" mention is made of two specimens of new essential oils from Java. One being an oil from the fresh herb of *Ageratum conyzoïdes*, which seems to contain a compound of the sesquiterpene series. The other is from the fresh leaves of *Cæsalpinia Sappan*, L., the tree furnishing Sapan wood. The odor of the oil is pepper-like, and dextrogyre-phellandrene seems to be the principal constituent.

HATCH EXPERIMENT STATION OF THE MASSACHUSETTS AGRICULTURAL COLLEGE. Bulletins Nos. 52 and 53. March and April, 1898. Amherst, Mass.

These bulletins contain information on concentrated feed-stuffs; spraying for the destruction of insects and fungous growths; and variety tests for fruits.

UNITED STATES DEPARTMENT OF AGRICULTURE, DIVISION OF BOTANY. Circular No. 14, 1898, pp. 7. This is a pamphlet by Lyster H. Dewey, assistant of the Division of Botany, upon Dodder's Infesting Clover and Alfalfa.

PENNSYLVANIA PHARMACEUTICAL ASSOCIATION.

The Pennsylvania Pharmaceutical Association will hold its twenty-first annual meeting in the Buena Vista Spring Hotel, Franklin County, on the 21st, 22d and 23d of June next. The first session will commence on the afternoon of Tuesday, June 21st, upon the arrival of the trains on the Western Maryland Railroad. It is expected that the Secretary will have the usual card orders for tickets, at excursion rates, to the place of meeting, which can be had upon application to him. Entertainment at the hotel will be furnished at $2 per day.

The place of meeting is in the heart of the Blue Ridge Mountains, close to the Maryland line, and near the well-known pic-nic grounds of Penmar. This locality is noted for its magnificent mountain scenery.

The Maryland Pharmaceutical Association will also hold its annual meeting at the same time in the Blue Mountain House, which is near, but it is in the State of Maryland. A programme will be arranged by which the members of the two Associations will be able to attend both meetings and participate in all evening entertainments. The meeting will certainly be a very interesting and pleasant one, and members should attend and bring their ladies with them, and become acquainted with the members of their neighboring State Association.

Harrisburg, Pa. J. A. MILLER, *Secretary.*

MINUTES OF THE PHARMACEUTICAL MEETING.

PHILADELPHIA, May 17, 1898.

The last of the series of Pharmaceutical Meetings for 1897–98, was held in the Museum of the College at 3 P.M. Joseph W. England presided. The minutes of the previous meeting were allowed to stand as published.

The exhibition of a collection of fungi first occupied the attention of the meeting. The exhibit was composed for the most part of specimens collected in the neighborhood of Lancaster, Pa., by H. W. Guth, P.D., Class of '98. Quite an interesting variety of genera were represented by these specimens, among which were two species of Amanita, one of these, Amanita muscaria, being noted for yielding the poisonous principle muscarine.

Of considerable interest was a sample of an edible fungus found growing in the province of Chikuzen, in Japan, which was received from Dr. Jokichi Takamine. This fungus is probably one of the Lycoperdons, and under the name of "shoro" it can be obtained in the markets of Japan, put up in small tin cans, about the size of those used in this country for canning oysters. Another specimen, and one possessing considerable interest for pharmacists, was received from Prof. J. B. Nagelvoort. This was a sample of the fungous product known as koji, and used in Japan for brewing purposes, instead of malt.

Among the remaining specimens were samples of corn smut (ustilago) in the various stages of its development. As a rule, it is found growing on the top portions of the Indian corn, this fact being interesting, as showing the means of disseminating the species.

In addition a number of the photogravures of American Fungi issued by Mr. C. G. Lloyd, of Cincinnati, were exhibited, his mycological collection probably being the finest in existence.

On motion, a vote of thanks was extended Dr. Guth for his donation.

A communication by Charles H. LaWall on "Hydrogen Peroxide as a Factor

in Spontaneous Combustion," was read by Dr. C. B. Lowe, (see page 291). The facts presented in this paper are not only interesting from the chemical point of view, but serve another purpose in warning those engaged in surgical practice against the probable danger attending the use of this solution.

Prof. F. X. Moerk in commenting upon the paper said that in making hydrogen peroxide solution, dilute sulphuric acid is added until the barium is precipitated out. He was of the opinion that the acidity of the solution is due to phosphoric acid, but that this also might cause charring.

A "Note on Sarsaparilla" was presented by Prof. Henry Kraemer. The author stated that sarsaparilla, like cinchona, had been the theme for classical research. And, that, what Flückiger had done for cinchona, Luerrsen, to some extent, at least, had done for sarsaparilla. He also said that at one time a large number of varieties were met with in commerce, but that, like the cinchona problem, the number had been reduced in general practice to but a few kinds, and in this country, judging from prices current, to but two kinds, namely Mexican and Honduras.

The different commercial varieties were classified according to their geographical distribution, the Mexican including the product brought from Tampico, Vera Cruz and interior portions of Mexico, and the Honduras including that brought from Guatemala, Belize and Honduras. The writer stated that by means of the microscope these two kinds are easily distinguished.

Referring to some of their microscopical characteristics, he said that the cells of the hypodermis of the Mexican variety show a peculiar thickening, which he designated as the gas-flame structure, while the cells of the hypodermis of the Honduras variety are square to slightly radially elongated in shape. Characteristic differences were also observed in the cells of the endodermis of the varieties named. Still another distinction is furnished by the tendency of the parenchyma of the Honduras sarsaparilla to become collenchymatic.

In considering the therapeutic properties of the drug, the author said that recent investigations appeared to confirm its value in this respect.

A number of interesting points were brought out in the discussion of this subject, and those taking part in it were the chairman, Dr. Lowe and Messrs. Boring and Stedem.

A short sketch of the life and work of the late Prof. Dragendorff was an interesting feature of the meeting.

In answer to a query by Mr. Boring as to the method of dispensing powders in capsules, the chairman said he believed that it is the general custom to make a mass of the powder, unless the prescriber directs using the powder in dry form.

The Chairman appointed a Committee to have charge of the Pharmaceutical Meetings for the ensuing year.

On motion, the meeting adjourned. THOS. S. WIEGAND, *Registrar.*

OBITUARY.

Henry H. Wolle, who was connected with the business management of this Journal for nearly twenty-five years previous to his resignation in 1894, died on February 24th, after a brief illness, at his home in this city. He was in the sixty-second year of his age, having been born in the neighborhood of Beth-

lehem, Pa. He was the son of Bishop Wolle, at one time senior Bishop of the Moravian Church. In his early life, Mr. Wolle was engaged in the hardware business and then in the silk trade. In 1861 he accepted a position in the United States Post-office in this city, which he retained during the remainder of his life. His efficiency in this line of work was duly recognized, and in 1876 he was appointed postmaster of the Centennial post-office. His work in connection with the JOURNAL as Business Editor was performed with devotion and care. He devised an original method of keeping the mailing-list and a system of book-keeping which were especially adapted to the requirements of the JOURNAL, and he placed the business department on a sound financial basis.

Professor Dr. George Dragendorff died at his birth-place, Rostock, Germany, on April 7th, as already announced in the May issue of the AMERICAN JOURNAL OF PHARMACY. He was born on April 20, 1836. His father was a physician and gave him all the advantages of an education that he was able. Young Dragendorff attended the public schools of Rostock and at the age of seventeen had finished his studies in the gymnasium. Being desirous of associating himself with pharmacy, he was apprenticed to the renowned Dr. Witte. After three years' experience he was acknowledged an assistant and in 1858 he passed the Staatsprüfung.

In order to become more broadly and deeply educated, especially in chemistry, he matriculated in about 1859 at the University of Heidleberg. He remained here until 1860, when he was called as assistant to Professor Dr. Schulze in the chemical laboratory at the University of Rostock. This he accepted and in the following year, 1861, upon the completion of an arbeit on "Ueber die Einwirkung des Phosphors auf einige kohlensäure und borsäure Salze" he passed his examination for the degree of Doctor of Philosophy.

We see that already Dragendorff had established his reputation as a student and investigator, and when we know the character of the man from his subsequent life, we do not wonder that he should be called in 1862 by the Pharmaceutical Society of St. Petersburg to become editor of the *Pharmaceutische Zeitschrift für Russland* and at the same time the director of the laboratories of the Society. In the latter were performed the chemical analyses for the government, and here he laid the foundation for his standard work, "Die gerichtlich-chemische Ermittelung von Giften," which has passed through four editions.

In two years his scientific labors attracted so much attention that he was offered the chair (Ordentlich Professor) of Pharmacy and the Directorship of the Pharmaceutical Institute in Dorpat, Russia. This he accepted and remained here for 30 years. He proved to be in the capacity of teacher as original as he was in everything else. He was in his teachings, as in his writings, clear and logical. Students were drawn to Dorpat to be taught by him, from all over the world. He lived to impart to his students what he knew and to make of them investigators, rather than storers of facts. That he succeeded is attested by the fact that the original publications, by his students of work carried on under his direction, in his laboratory at Dorpat, number at least 400.

His broad educational views, his scholarly training, his natural resources and his scientific achievements caused him to be elected by his colleagues of the Faculty, Prorector of the University of Dorpat, from 1883 to 1887. The sterling

character of the man and his labors were not only appreciated at home, but also abroad. In 1872 he was given an honorary degree of Doctor of Medicine by the University of Munich. In 1875 he was elected an honorary member of the Pharmaceutical Society of Great Britain, and in 1885 he was awarded the Hanbury Medal. In this country he was made an honorary member of the American Pharmaceutical Association in 1868, and of the Philadelphia College of Pharmacy, November 6, 1883, having been previously a corresponding member. It is estimated that he was an honorary or corresponding member of no less than forty different scientific bodies. Notwithstanding the large number of dissertations that emanated from his laboratory, his own scientific papers and books are estimated as being not less than 115 in number. His earlier papers appeared in the *Pharmaceutische Zeitschrift für Russland.* Many of his works

were translated into English, French, Russian and other languages. Some of the important contributions to science from the pen of Professor Dragendorff are:

1868.—"Die gerichtlich-chemische Ermittlelung von Giften," St. Petersburg. A fourth edition of which appeared in 1895 and was reviewed in the AMERICAN JOURNAL OF PHARMACY, 1895, p. 427.

1869.—"Materialen zu einer Monographié des Inulins." St. Petersburg.

1871.—"Beiträge zur gerichtlichen Chemie einzelner organischen Gifte." St. Petersburg.

1873.—"Manuel de Toxicologie. Traduit par E. Ritter." Paris. A second edition of which appeared in 1886.

1874.—"Die Chemische Werthbestimmung einiger starkwirkender Drogen."

1874.—Sur la recherche des substances amères dans les bières." Bruxelles.

1874-1879.—"Jabresbericht für Pharmacognosie, Pharmacie, Toxicologie." Göttingen. From 1876 until 1879 he was associated in this Year-book with Marmé and Wulfsberg.

1875.—"Analyse Chemique de quelques drogues actives." Paris, 1875.

1875.—"Herbstzeitlose im Bier." (Vom deutschen Brauerbund herausgegeben). Frankfort, A. M.

1876-1887.—"Sitzungsberichte der Dorpater Naturforscher Gesellschaft."

1878.—"Chemische Beiträge zur Pomologie unter Berüchsichtigung der liévländischen Obstcultur."

1881.—Die qualitative und quantitative Analyse von Pflanzen und Pflanzentheilen." Göttingen.

1884.—"Plant Analysis: qualitative and quantitative." Translated from the German by Henry G. Greenish.

1885.—"Analysen verschiedenen Kaffeesorten aus Brasilien."

1885.—"Analyse chimique des végétaux (Encyclop. Chimique)." Paris.

1898.—"Die Heilpflanzen der verschiedenen Völker und Zeiten," Stuttgart, of which, Parts one and two have appeared and were referred to under Reviews in the May number of the AMERICAN JOURNAL OF PHARMACY.

In 1894 the University of Dorpat suffered a change in its administration. Its name was changed to the Russian Jurgjew, the German scientific spirit was abandoned, and Professor Dragendorff, among others, left the University. He then returned to the home of his youth and built, in connection with his home, a laboratory, where he continued his investigations and writings. Dragendorff belongs to the pioneers of this century, a few of whom still remain. In forensic chemistry and the methods for performing plant and toxicological analyses he has been the recognized author and guide. He belongs with Maisch, Flückiger, Hager, Trimen, Procter, all of whom have gone to their rest, and yet with whose labors the science of pharmacy was enriched and with whose influence the profession of pharmacy was elevated and honored.

The Admission of United States Students to French Schools, according to General Horace Porter, United States Ambassador to France, cannot be secured without the formal application of their diplomatic representative. Nor can any foreign student be admitted to any of the schools of France—medicine, pharmacy, dentistry, veterinary, painting, design, architecture, music, declamation, engineering, etc.—without this formality. In most cases two letters suffice; one making application, the other expressing thanks when the request is granted. Sometimes more correspondence is necessary, for the reason that those proposing to enter any of the high-grade schools have to produce certain certificates of studies, or diplomas, which the authorities accept only when they come through the embassy. No discrimination is made against Americans; on the contrary, the authorities extend all possible facilities to them. There is a large number of American students in Paris, and, as a rule, they are much liked by the teachers in French institutions.—*Consular Reports,* Vol. LVI, p. 363.